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THE

QUARTERLY

JOURNAL OF AGRICULT

VOL. VIII.

JUNE 1837—MARCH 1838.

WILLIAM BLACKWOOD & SONS, EDINBUR(
T. CADELL, STRAND, LONDON.

MDCCCXXXVIII.

PRINTED BY NEILL & CO., OLD FISHMARKET, EDINBURGH.

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ON SMUT, CANKER, AND RUST OR MILDEW IN CORN, WITH THE ALLEGED AND ASCERTAINED CAUSES, AND MODES OF PREVENTION.

It has recently been said, that the numerous conflicting opinions as to the cause of smut, render it impossible to recommend any certain mode of investigation to clear up this perplexing subject, and, after all that has been written upon it, the cause of the disease in corn may be regarded as one of those secrets of Nature with which the human mind will probably never be intrusted. Not one single opinion has been advanced on this subject, it is farther said, that has not been refuted; so that it would appear, the more we inquire into the mysteries of the works of Nature, the more they are presented to the human mind in a perplexing form.

Now, it is to be feared that remarks of this kind are very apt to damp and deaden the spirit of inquiry, and to prevent the investigation of points which have hitherto baffled research. This, however, ought not to be, so long as the field of discovery is so amply and daily rewarding those who endeavour to extend its boundaries. It is to be lamented, not only that the labourers are few, but also that the inquiries of scientific men are so rarely directed towards subjects of the highest interest to practical cultivators. A striking instance was recently given, in this jour-

nal, of the hop-fly (*Aphis Humuli*), never yet figured, nor its history minutely written, while other insects of no particular interest to farmers are carefully traced from the moment they are hatched till they die. It sets the apathy of scientific men to subjects bearing a practical tendency in a strong light, that some imaginative remarks, and a few loose and inaccurate experiments, by an unknown anonymous periodical writer who signs Rusticus, respecting the turnip-fly, or rather beetle (*Haltica Nemorum*), should have been copied as important in almost every journal, both in this country and the continent, yet when these were taken up by a man of science,—J. O. Westwood, Esq., Secretarty to the Entomological Society,—and shewn not only to be erroneous, but impossible: the anonymous writer tardily and reluctantly gives in. Similar fancies, given as actual observations, from the same quarter, have been extensively propagated in a similar way respecting the apple weevil and the burrowing beetle.

In the same way, the greatest errors have obtained respecting the rust and the smut in corn,—the investigations having been chiefly conducted by practical men not acquainted with science, or by scientific men ignorant of practical matters. By passing in review the chief points connected with the interesting subjects of smut and rust, it is not to be expected that errors can be avoided, though it is of high interest to know that several recent discoveries, bearing on the point, tend greatly to lessen the chance of error, from opening new, unexpected, and simple views of the economy of nature in the production of these destructive agents. It is to be hoped that these more correct views will soon take their place in practical works, instead of the prejudices, to call them by no other name, propagated from one writer to another for successive ages. It will be requisite, before proceeding farther, to determine the obvious external characters by which these affections of corn may be distinguished, as there can be little doubt that some confusion prevails both among botanists and agriculturists in this respect. There seems, then, to be three affections of corn apparently very distinct in character, though often confounded (*see Rees' Cyclopædia, Art. Smut—Plenck, infra*), namely, Smut, Canker, and Rust or mildew.

1. *Smut.*

What is termed smut, smut-brand, burnt corn, soot dust-brand, and black corn in England; and *la bosse*, *nielle*, *nielle volante*, or *charbon*, by the French, meaning, by these terms, "crimpled, blasted, or charred corn," occurs most commonly among oats, but is also found affecting barley and wheat. Mr Kirby (*Linn. Trans.* v. 113.), Dr Greville (*Flor. Edin.* 443.), add rye; but M. Tillet says, he never met with a smutty ear of rye (*Dissert.* p. 133.); and Plenck says, if it occur at all, it is exceedingly rare in rye (*Patholog. Plantar.* 153.). M. Decandolle says, that, besides oats, barley, and wheat (he does not mention rye), it attacks millet, maize, and several sorts of grasses; such as *Agrostis pumila*, *Triticum repens*, *Avena pratensis*, and *Paspalum dactylis*, (*Encycl. Meth. Bot.* viii. 227). Kirby adds *Festuca fluitans* and some other grasses. M. Tessier found, by repeated experiment, that bearded wheat was less subject to smut than smooth wheat,* a fact which, if ascertained, would be highly important to farmers, in districts where smut is prevalent.

So early as March or April, M. Duhamel, upon carefully opening the envelopes, and examining the embryo seed, then not one sixth part of an inch in length, found it already black, though he is of opinion it may not always affect the plants at so early a stage. The Rev. Henry Bryant (*Causes of Brand*, p. 42–4) gives a more minute account of the early stages of the affection, though somewhat vitiated by a mistaken theory. When the corn is what the farmers term "in the milk," if it be squeezed, a sweetish liquor oozes out,—the basis of the future farina, which, becoming diseased instead of hardening into ripe grain, grows *oily* and *rancid*, *ferments*, *turns sour*, and *curdles*. These changes commence soon after the corn is in bloom, and may be recognised by the embryo grain bulging out more than it ought to do, pushing out the chaffy envelope by its swelling, so as to cause the valves to stand more widely apart than they ought to do. This difference in the figure of the ear, will enable the observer to recognise ears affected with smut at an early stage, before any blackness is apparent.

* We believe that bearded and woolly-eared wheat are less liable to be attacked by the wheat-fly than the smooth kinds.—EDITOR.

As the ear continues to grow, or, as Mr Bryant says, "when this *fermentation* is over, but not before," the embryo grain assumes a darker colour, which grows deeper and deeper every day, till it is quite black—constituting the brand. "I opened," says Mr Bryant, "some of these seed-buds when they were most swelled, greenest, and consequently less forward in their progressive advancement to this sooty state, and found that the curdled milk had not gained everywhere the same degree of consistence in them. Those parts nearer the surface were driest and blackest, those near the centre clammy, dirty, tinged with yellow and green, and which, by the microscope, appeared of no certain and determinate figure. The particles stuck together, were easily separable into others, and those again separable *ad infinitum.* To the palate, they were not gritty, but soft like the finest flour, melting away without leaving any particular taste behind them, except a little bitterness."—(*Inquiry*, p. 45.) When the distempered ear bursts through the leafy sheath, it appears lank and meagre, and the chaff immediately covering the grain is so thin and translucent, that the black-smut within is easily perceived. If one of the upper leaves on a stem appears streaked or clouded with yellow and green, or dry and withered at the tip, it is highly probable that the ear will be smutty. M. Tessier says that this character never deceived him.—(*Maladies des Grains*, p. 296.) When the chaff bursts, as it speedily does, the spikes or heads look as if they had been charred by fire—hence the terms *brand* and *charbon.* When more advanced, there remains of the chaff only the formless fragments of a whitish colour, intermingled with the black dust. Sometimes, though rarely, the ears are enveloped in a membrane similar to the sheath (*spatha*) of lilies. The black dust insensibly becomes dry, and is scattered by the winds or washed away by the rain, nothing being left for the farmer to house but the barren skeletons of the spikes.—(*Tessier*, p. 296.)

The upper part of the stalk of corn infected with smut is usually less straight than a healthy one, the deviation beginning about half an inch beneath the spike; but, as Mr Bryant remarks, the infected plants, taken as a whole, are more upright than the healthy ones; for the milky juice which should have been consolidated into heavy grain is wanting, and the quantity

of matter being much less in the smutty ears than in the healthy ones, will keep them in the upright posture, while the others are bending beneath their own weight.—(*Disease in Wheat*, p. 47.) When a stalk of this description is squeezed there, it scarcely yields in the least to pressure; and, if cut asunder at about a sixth part or a quarter of an inch below the spike, it will be found to be entirely filled with pith, so that only a very small tube can be perceived in the centre, instead of the large one always present in healthy plants.—(*Tillet, Cause qui corrompe les Grains*, p. 73.) The stem of smutty corn, when strongly pulled, separates at the first upper joint, and the lower end of this joint is distinctly sweet to the taste, similar to what is observed in healthy plants, a fact which M. Tessier thinks is good proof that the sap is not altered on entering the plant, nor till it has passed higher up than this joint.

Sometimes only a part of the ear is infected with smut. "I have seen," says Kirby, "more than once, half an ear of corn affected, when the other half was good and sound;" and Tessier says, it is in such cases only those grains nearest the spike-stalk which are smutty; while Mr Bryant has observed even the embryo or germen itself in branded ears as green and well shaped as in those not infected. Sometimes the half of the sheath, or hose, is affected with smut and converted into black dust, in which case the sound part encloses blossoms that are developed and bear grain capable of arriving at maturity, though smaller in size than healthy grain; for, in such cases, the stalk grows more or less after the ear has appeared, while at this period vegetation is quite finished in plants entirely smutty.—(*Tessier.*) The whole ear, according to Bauer, is often found entirely destroyed, many weeks before even the individual florets are entirely developed, or the sound ears emerge from the hose. Sometimes, but rarely, the infection takes place after the blooming, and its progress is then more easily traced. The embryo or germen is generally the first attacked and found partially or half filled with smut; then the pistils, the stigmas, and the anthers. Oats are often later in being affected than barley or wheat, the whole head frequently issuing from the sheath, or hose, to all appearance in a perfectly sound state, or perhaps with only a few black spots on the spikelets at the base; but these spread

rapidly, and, even after being separated from the stem, will continue to be destroyed by the smut so long as any moisture remains. "I once," says Mr Bauer, "collected and cut off several such partially infected ears, which I intended to preserve as specimens, and for that purpose I laid them in brown paper to dry them: they were accidentally mislaid and did not come into my hands again till after a period of six or seven months, when on examination I found the whole specimens were consumed."

The writer of this paper collected a considerable number of smutty ears of oats near Coblentz, on the Rhine, in 1832, and kept them in a wooden box for the purpose of experiment, but the stems now (1837) are as fresh as when gathered. Probably these stems, when gathered, might be in a drier state than Mr Bauer's, and this may account for the difference.

Mr Kirby says he could never observe any diseased appearance about the root, and that sometimes it affects all the stems tillering from the same root, while at other times some are healthy and some diseased. The Abbé Tessier is disposed to consider the latter statement, which had also been made by Tillet, as inaccurate; for though, on taking up plants in the fields, he had occasionally found healthy and smutty plants apparently springing from the same root, he found, on careful examination, that the roots were not the same, but interlaced so as to be separable. It is certain that the plants affected with smut carry fewer stems—not above two or three—than healthy ones. Besides, the secondary stems which rise from the roots of smutty plants, have rarely sufficient vigour to shoot up many inches.

Mr Lathbury examined, by means of a powerful magnifier, the black smut powder, and found that it consisted of a number of minute particles of a uniform size and shape, much smaller and blacker than those of the canker or pepper brand, and less easily separable, while they seemed to be contained in small cells of an irregular form. Mr Kirby says that a small shining black beetle (*Dermestes ater*, Marsham) feeds upon it.

The most recent investigations respecting smut are those of Adolphe Brongniart, the results of which we shall now detail. The mode which he adopted was to ascertain what part of the plant is first attacked, how it is first manifested, and to com-

pare the different states of the tissues when affected or not affected.

In consequence of the smut not generally showing itself till the ears are developed and escaped from the hose or sheath, M. A. Brongniart long sought it in vain in very young plants, but at length he was successful. In the month of August he observed a field of barley, in a very poor soil, extensively affected by smut, so as to render it easy to trace it through its different stages. On examining, in this manner, the diseased spikelets, instead of finding every part infected, as is usually asserted by authors, he found that smut was quite beneath the parts of fructification, which had been pushed upwards by the growth of the smut, and reduced to a diminutive size, or what he terms a rudimental state, their interior parts remaining unaffected by the smut. The smut again occupied an egg-shaped fleshy mass below the parts of fructification, which appeared to be nothing but the foot-stalk supporting the grain, increased to a monstrous size by the disease. On the summit of this fleshy egg-shaped footstalk, were seen the three stamens, with exceedingly short filaments and anthers, of the usual form, but destitute of pollen. The seed organ (*ovarium*), however, was so much shrunk, as only to be traced in the form of two scale-like substances, and a minute ovoid tubercle deprived of stigmata.

From these apparently exact and very minute observations, it follows that, instead of being developed, as usually supposed, in the seed organ and the parts surrounding it, as is the case in canker or pepper brand, smut produces a sort of atrophy, shrinking, or abortion, of all the floral organs, developing itself in the footstalk or peduncle, which it swells out to an excessive magnitude, and transforms it into a mass, first fleshy, and afterwards of a powdery consistence.

It will be evident from these details, that M. Adolphe Brongniart is altogether original in his observations, which do not correspond in any part with the researches of previous observers, and is directly contradictory to the equally minute researches of Mr Bauer, who figures the smut as infecting every part of the plant,—the joints, the stem, the leaves, the footstalk, the chaff, and all the parts of the flower and the fructification. Greville also describes it as infecting " the fruit and

glumes of corn and various grasses, spreading, and in a short time filling, the whole with a profuse black dust." (*Flora Edinensis*, p. 442–3). Lamarck also says "it springs up under the epidermis, destroying sometimes the whole of the pulp (*parenchyme*) of a spikelet, sometimes of an entire spike." (*Encl. Method. Bot.* viii. 228). In describing the attacks of smut upon maize, M. Decandolle says, "it puffs up the epidermis of the grains so as to change their form, and cause them to attain the size of a plum; and it destroys the mealy substance, imparting to the epidermis filled with black dust no bad resemblance of a puff-ball (*Lycoperdon*)." (*Synops. Plant. Gall.* No. 615, p. 47). Willdenow likewise says it "occupies the whole ear, which therefore cannot form itself properly, every part of it becoming a black, soiling mass." (*Grundriss. Botanisch.* 331). "Its attacks," says Burnet, "are not confined to the grain, but it equally affects the husks, leaves, and culms," (*Outlines of Botany*, i. 186); and he makes this statement with Brongniart's figures before him.

2. *Canker.*

What is termed canker, pepper brand, smut ball, and brand bladders, in England, and *le carie, cloque, chambouale*, &c. by the French, meaning by these terms "cankered, mortified, or putrid grain," occurs solely among wheat, and does not seem to have been observed infecting other grain. It is very distinct from smut, as we shall show, though often confounded therewith.

The Abbé Tessier says, it is only the well experienced eye that can detect a cankered ear of wheat before it issues from the sheath or hose, when the stems and leaves are slender, and of a duller green than those of healthy plants. On opening a sheath containing a cankered ear, and spreading the grains, there is seen a small body, of a green colour, apparently the embryo grain bulged out, and bearing on its summit the two stigmata without any feathering, and farther down the three anthers, lax and without pollen. If this small body be pressed between the finger and thumb, it emits an unpleasant odour. (*Maladies des Grains*, p. 119).

In June, when the ears have issued from the sheaths, the

cankered ones are easily recognised, by being bluish, more narrow, and the grains more closely pressed to the stem (*rachis*). At this period the infected grain is covered with a thick green membrane, enclosing a whitish pulp, and still bearing the stigmata on the summit, while the anthers, small and yellow, seem glued along the side of the grain, and do not exceed it in height. The fœtid smell is also now much stronger. (*Tessier*).

As the growth advances, the spike ceases to have the grains so close to the stem (*rachis*), and even becomes larger than in healthy plants. The chaff opens as if unnaturally distended, the embryo or germen becomes shorter and rounder, and exhibits the appearance both of swelling and, as Kirby expresses it, "inflammation." Instead of the pale, pleasant green, which is the healthy colour of the grain, it assumes a deep dingy hue. The pulpy substance passes successively from whitish to ashy-grey and greyish-brown, and the stigmata are now reduced to the form of slender threads. The maturity of the cankered ears is more early effected than in healthy plants, in the same way as diseased fruit ripens soon. This maturity is indicated by the yellowness of the stems, and the greyish-brown of the cankered grains, which are filled with a black powder, that rarely, as is the case with smut, bursts through the husk or bran envelope; but when it is bruised or opened, emits a fœtid smell worse than that of putrid fish, and when walking to leeward of a field much infested with canker, the smell is scarcely supportable. (*Tessier*). The wheat plants, as Mr Bauer says, which are infected with canker, may readily be distinguished by their greater size, being several inches taller than the healthy ones. In all instances of cankered wheat, he found a greater number of stems produced from the same root, the spikes containing more grains, and those more perfect in form. The Abbé Tessier says, he counted as many as sixty-eight grains in a cankered spike, and rarely so many in healthy ones. "One plant," says Mr Bauer, "produced from seed which I had inoculated, had twenty-four complete stems and ears, some of the stems with the ears measuring above five feet, every part of the plant proportionally large, and all the ears entirely infected. Another specimen had eight stems from the same root, five of them above six feet high, and the ears entirely infected;

the other three stems considerably shorter, their ears smaller, and the grains perfectly sound.

MM. Tillet, Duhamel, and Aymer, assure us, that they have found in the same grain of wheat sound white farina in one part, and the powder of canker in the other, but the Abbé Tessier never met with this. He found, however, that some spikes were infected on one side only, while the opposite side was healthy. In some instances, five or six perfectly sound grains were found in an infected spike, and in other cases a few thoroughly infected grains were found in a spike otherwise healthy; and again, the diseased grains are seen scattered in different parts of the spike, intermixed with the healthy ones. Hence, it would appear Mr Bauer generalizes too far, when he says that "the infected grains are always in the last spikelet of the ear." Mr Bryant, indeed, makes a remark quite the reverse of Mr Bauer, for he says, "in those ears which are partially brairded, the diseased parts are always seated *beneath* the sound and healthy." (*Causes of Brand*, p. 49). In a quantity of infected grain which furnished twelve ounces and three drachms of canker, the Abbé Tessier found only three ounces of sound wheat.

M. Duhamel having more than once found smut and canker on the same spike, was led to believe that canker was only the earlier stage of smut; but the conclusion, as will afterwards be seen, is not supported by recent discoveries. (*Tillet, Cause qui Corrompe*, p. 75).

Cankered grain is of a rather oblong form, unequally rounded, and upon the whole resembling sound wheat. At one of the extremities two projecting threads, the remains of the stigmata, and at the other the fibres of the bran-envelope or skin approach, while there is no germ, and the usual furrow is not so deep as in sound wheat. The colour of the grain is greyish-brown, and with a magnifying-glass it appears wrinkled like the outside of a puff-ball (*Lycoperdon.*) The interior is filled with a fine black powder, greasy to the touch, and without taste, and smelling as already remarked of putrid fish. When it has been some hours infused in water, and then examined by the microscope, it appears as a mass of semitransparent globules, very distinct, and adhering to each other as if pressed together.

According to Tessier, they vary in diameter from $\frac{1}{140}$th of a line to $\frac{1}{280}$th, while those of wheat vary from $\frac{1}{70}$ to $\frac{1}{360}$th of a line. Mr Bauer represents the globules of canker as nearly equal in size, and of the $\frac{1}{1600}$th part of an inch in diameter,—shewing that 2,560,000 would cover a square inch. The grains of canker are very light; a measure which contained ten ounces of wheat having been filled with four ounces and a drachm of cankered grain, of which six drachms were chaff.

3. *Rust or Mildew.*

This in England is termed Red-rust; by the Italians, *La ruggine del grano*; and by the French, *La rouille.* It chiefly attacks wheat and barley, but is also found on other grasses and reeds. (*Greville, Flor. Edin.* 433.)

It has been longer understood than the preceding diseases, having been first, we believe, elucidated in 1767 by the researches of Fontana (*Osservazioni sopra la ruggine*), who gives tolerably good magnified figures of the rust; and subsequently by Duhamel, Tillet, Tessier, Kirby, and more particularly by Sir Joseph Banks and Mr Bauer, who have given admirable figures of the parts of plants affected. It first makes its appearance on the upper leaf, and then on the lower leaves and the stem, in the form of small white spots, scattered irregularly like spots made by rain on new cloth. These spots gradually increase in size and number, and assume a reddish tinge, and at length form a sort of dust-looking powder, of an ochre or orange yellow, little cohesive, and without smell or taste, and therefore very different from canker or smut. It stains the fingers yellow, as well as the clothes of those who walk amongst the infected corn.

The dust-like substance of the rust originates beneath the outer bark or epidermis of the plant, which it raises up, renders thin, and at length cracks and bursts through. When examined by the microscope, it presents a congeries of egg-oblong bodies, some of which have projections almost like tadpoles or *powheads*, though they are not animated, as M. Ginani seems to suppose (*Delle Malatie del Grano*), for, when the Abbé Tessier put them into warm water, it did not cause them to move. (*Maladies des Grains*, p. 201.)

Wheat is attacked with the red rust at different periods of vegetation, but more particularly when in the ear. When the rust seizes young plants, they are said to suffer less than when they are more advanced, often recovering vigour before blooming; whereas at a later period they sustain irreparable damage, and crops which promise well are often in a short time rendered comparatively worthless. In this case the texture of the leaves is disunited, and presents only longitudinal fibres of a brown colour, while the joints and the tubes of the straw between are blackened as if they had been scorched by fire, the growth ceases, a portion of the ear becomes yellow, another portion remains green, and the grain shrivels up in the husk without attaining maturity.

The evil, however, is rarely carried so far as this, and the yellow spots of rust become chocolate-brown or black, without disorganizing the portions of the plants where they occur; and the Abbé Tessier says he has seen, after heavy rains, the clothes of the reapers stained with this black substance of the rust as if they had been dipt in ink. But though the plants are not disorganized, the flow of the sap is interrupted, the ripening of the grain is prematurely hastened, and it is hence light, containing a small proportion of farina, while the straw is bad. Sometimes the rust only leaves a yellow powder on the husks and the upper end of the grains, taken by Fontana and others to be a different species.

Sometimes rust prevails so extensively that few fields escape, but for the most part it is observed in fields sheltered from the north winds by walls, hedges, or woods, or where vegetation is very luxuriant on account of fresh soil or abundant manuring. Sometimes one part of a field escapes while the other is attacked; sometimes the chief plants, and at other times the side shoots tillering from them are affected; and sometimes rusty and sound plants grow from the same root.

We are not by any means certain whether this is the same as the mildew described by Mr Kirby * (*Linn. Trans.* v. 123), who makes it very distinct, however, from the red gum and blight. In the year 1797, he says, the wheat suffered much

* Probably *Uredo linearis*, Pers.; *U. longissima*, Sowerby.

by mildew, as our farmers commonly call it, by far the worst enemy of that grain. The ears that were injured by it were to be distinguished at a considerable distance by their blackness; and when brought close to the eye they appeared as if soot or some other smutty powder had been strewed over them. Under a common lens, the chaff appeared covered with small black dots, irregularly scattered over it, and widely different from the appearance of the rust. Whenever this appearance seizes the ear, it invariably occasions the grain to shrink so much as to be fit, he thinks, only for feeding hogs or poultry, but certainly not good for them. Mr Kirby, writing from recollection, thinks that this mildew was confined to the ear; but farmers told him that the straw also was always injured.

The red gum, as described by Marsham and Kirby, differs in growing usually on the inside of the husks, under the bark or epidermis, like a pustule on the human skin, and through which it at length bursts, emitting a powder of a bright orange colour. It does not appear that this injures the grain, for Mr Kirby has seen ears quite full of it, and yet plump with farina.

Another similar affection, commonly called by the vague name of *blight* * (which should be excluded from all such discussions), is described as growing upon the leaves, stem, and chaff, also under the bark or epidermis, through which it bursts in longitudinal streaks of a black colour, causing it to appear split. Mr Lambert says (*Linn. Trans.* iv. 193), that, in 1797, it injured the wheat very much, and several fields near Warminster were so infected with it that the farmers cut them down long before they were ripe. Mr Kirby, on the other hand, says, that, "after repeated examination of ears, the straw of which was quite black with it, in no one instance was the grain injured by it." (*Idem*, v. 122.) It is by no means certain, however, that these writers refer to the same thing.

Alleged Causes of Smut, Canker, and Rust.

In the preceding details, considerable care has been taken to exclude reference to causes real or supposed, except in quoting Mr Bryant respecting smut. This was deemed the more ne-

* Probably *Puccinia graminis*, Pers.; *Uredo Primuli*, Sowerby.

cessary, that, notwithstanding scientific men have been long agreed as to the chief facts, this is by no means the case among practical agriculturalists, who in many cases adhere to traditionary popular opinion, and practical empirical remedies founded on these opinions. Even scientific men are often, as we shall presently see, biassed by popular opinions, so as to adopt mistaken notions, derived from imperfect or inaccurate observation. It may therefore be useful, even at the present day, to mention a few of the alleged causes before coming to the real cause.

1. *Insects.*—Insects which feed on vegetable substances, from being very numerous and of many species, are always more or less apt to be found on corn, whether sound or diseased. Several of these insects, such as the wheat-fly (*Tipula Tritici*), do extensive damage; but it is of a very different kind from those caused by smut, canker, and rust. It is probable that it was the grubs of this or some other fly which the author of the "Yorkshire Farmer" found in his smutty wheat, which led him to ascribe it to this cause.

M. Tillet gives a very minute account of the observations which he made with the view of ascertaining the effects of insects in producing canker. At the beginning of June he unfolded an ear of wheat from its hose, and saw issuing out of it a swarm of small black insects, rendered very obvious by their colour. Induced by this discovery to examine other plants, he found the same insects in great abundance. The insects were long-bodied like earwigs, of the sort termed *staphylinus.* On the smutted ears he found few of these insects, but on the cankered ones he found many of the black insects, together with others much smaller, of a red colour, the latter more common during the blooming period. In a word, he satisfied himself that the red insects were the grubs of the black ones, whose eggs and excrements he also found both on healthy and on sound ears.

After many experiments and observations, he could not find that these insects devoured any part of the grain; but he adopted the opinion, without, it would appear, very rigid proof, that they fed upon the pollen, and hence the stigmata being deprived of fecundating stimulus, the grain became cankered,—a

cause, as we shall afterwards see, inadequate to produce this effect.

A very intelligent agricultural writer, the late Mr Sommerville, convinced himself that smut was caused by insects, and founded upon this plan for preventing their destructive ravages. (*Commun. to the Board of Agricul.* vol. ii.) By using in the course of his researches magnifying-glasses of high powers, and concentrating the sun's light on ears affected with smut, by means of a concave mirror, he observed small insects of the form of wood-lice, perhaps the same as those described by M. Tillet, or more probably the beetle (*Dermestes ater*), mentioned by Mr Kirby, for a person not much conversant with insects might suppose either of these to resemble wood-lice. Be this as it may, the author gives it as his opinion, that the smut is occasioned by the small insect observed by him; for the smut-balls being either broken by the flail or otherwise brought into contact with healthy grains, the insects leave the smutted grains, and adhering to such as are healthy, are sown with them, and wound the tender stem in such a manner as to render it incapable of producing any thing but smut. It may be remarked, however, that this is only conjecture, as insects were not actually observed to have been sown with the corn, much less were they seen to wound the stems; and farther, it was not proved that smutted ears had their stems wounded in any way.

Sir John Call is another supporter of the doctrine of smut being caused by a similar cause. He maintains that it is produced by certain animalcula, deposited in the husks of the ear when the wheat is in blossom, and that these are fed and nourished by the milky juice in the unripe grain. The reasoning, however, as well as the experiments adduced by Sir John, are vague and inconclusive, as well as in opposition to the best established facts on the subject.

In reference to these views it is recorded (*Farmers' Mag.* vol. iii.) that an Irishman employed at Alloa in Clackmannanshire, to stamp linens, instructed a farmer in the Irish method of preventing smut by kiln-drying the seed-corn so as to kill the insects. It is said that after the wheat had begun to be heated in the kiln, a great number of very small worms, previously invisible, make their appearance on the top of the

grain, and are soon killed by the heat. Now, there can be little doubt of this fact of the appearance of the worms, few parcels of corn being without some species of insect; but this does not in any way prove that these worms are the cause of smut. Although, therefore, the opinion in question was adopted by Linnæus and many others, we may safely conclude in the words of a much higher authority respecting insects, the Rev. Mr Kirby, that the notion of brand (and he might have correctly added smut and rust) being "produced by insects is not supported by one fact or experiment that I have ever heard of." (*Linnæan Transactions*, v. 120.)

2. *Imperfect Fecundation.*—Amongst the supposed injuries already mentioned, as referred to the agency of insects, the devouring of the pollen holds a prominent place; but independently of insects interfering in this way at the important period of blooming, other causes have been alleged by Dr Darwin and others to operate injuriously. (*Phytologia*, p. 323.) Heavy rains at this period, by washing away the pollen, may no doubt do great damage, as they are known to do to the blossoms of fruit trees; but that this will cause smut, as has been asserted (*Bath Society's Mem.*), is not supported by more than conjectural evidence. Dr Darwin's analogy drawn from the non-fecundated eggs of fowls becoming addled on hatching, is more ingenious than correct.

M. Duhamel's refutation of all such opinions is quite unanswerable. Smut, he remarks, affects and destroys the organs of both sexes, long before the time of fecundation; and it cannot be imputed to wet or other causes acting on the anthers, &c. for the ears are frequently smutty long before they issue from the hose-leaves, which continue green till the distemper has made great progress. (*Agricult. by Millar.*)

The opinion of Wolfius, that smut originated in a monstrosity in the embryo seed, is no less erroneous, as it does not agree with the facts observed in the progress of the affection already minutely detailed.

The opinion of the Rev. H. Bryant alluded to above, is partly analogous, as he supposes the disorder caused by the milky juice in the ear running first into fermentation, and then into *brand*, by being prevented from blooming in consequence

of the anthers, as Kirby understands him, or as we rather think he means, the sheath-leaf or hose hardening over the ear by the weather, and preventing its evolution and proper blooming, (*Cause of Brand*, p. 51.) But even were it well ascertained, as it is not, that the anthers or the sheath-leaves were so agglutinated as to prevent their duly expanding, this would not account for the disease taking place so early in the growth as it has been often found.

3. *Over-luxuriant Growth.*—Dr F. Home, in his celebrated prize-essay—the foundation of British Agricultural Chemistry—supposes that smut is caused by an over-abundance of juices, or in other words, from too luxuriant growth; and in this he is partially followed in Chambers's Cyclopædia, where the cause is said to be the rankness of the soil or the use of fresh dung. Mr Donaldson says, that on rich lands that yield much straw, over-luxuriance, or stagnation and corruption of juices, gives a probable appearance to this being a cause of smut; and we ourselves have frequently observed that stray plants of oats or barley grown on dunghils, or compost heaps, are very commonly affected with smut. This, however, is too vague an observation to draw a general conclusion from; and there can be no question, as Mr Donaldson remarks, that smut is equally prevalent on poor soils, not yielding above fifteen bushels per acre.

It is a popular notion in France, as we learn from M. Duhamel, that the dung of pigeons or of sheep causes smut, probably from some similar observation to the one just mentioned respecting dunghils; but it did not agree with the experiments of Duhamel, who says, "we have large pigeon-houses, the dung of which is strewed upon our wheat-lands, and the same is done with the dung of our sheep, and we even feed our flocks upon those lands; yet we do not find that these fields are more affected with smut than others." (*Agric. by Millar*, vol. ii.)

It appears to be from similar views that Tull and others have been led to ascribe smut to too much moisture either of the soil or of the seasons. That wet seasons are more productive of smut than dry ones, there can be little doubt, though this by no means proves such seasons to be the cause of smut, but only that its development is favoured by moisture more than by

dry weather. With respect to soils, it does not appear that a greater number of affected ears are usually found in the lowest and richest parts of a field, than in the highest and dryest, facts which have been proved by the observations of Duhamel, Tessier, and other writers of authority. The drill husbandry, therefore, recommended by Tull as a preventive, can in this respect be of little advantage. M. Tillet, in order to put this matter to experimental proof, planted some wheat, which he kept during its growth in a very moist state; but the result was, that it did not produce a single ear affected with smut.

4. *Debility in Growth.*—The fallaciousness of the preceding views respecting over-luxuriance, is rendered obvious from the very opposite doctrine having been maintained. M. Aimen, for example, an intelligent French writer, is of opinion, that whatever weakens the plant is apt to produce smut. He proves this view, he thinks, that it is a frequent practice with the farmers on the Continent to cut down their rye as soon as it spindles as food for their cattle; and that the rye which tillers up from the cut plants, most commonly on account of weakness, produces distempered ears. M. Aimen also tried the experiment of wounding seed-corn with a needle, and found it subject to smut, similar to that which had been imperfectly ripe, which also is very liable to smut when used as seed.

Similar experiments with those of M. Aimen did not, however, succeed with Dr Hales, the celebrated author of the "Vegetable Statics," who, conceiving that smut might be caused by the seed-corn having been bruised by the flail in the process of thrashing, took a number of grains of different sizes, bruised them with a hammer, and sowed them, but they grew well and were not affected with smut.

Lisle, proceeding upon the mistaken notion that smut only affects grain when the growth is in an advanced state, thinks it is caused by a total want of sap at the root. (*Observations on Husbandry.*) W. Ellis, again, the well known economical farmer of Little Gaddesden in Essex, is led to conclude that smut arises chiefly from want of nourishment in the root.

Debility in growth, besides, is quite inconsistent with one of the commonest appearances of infected corn, that of standing considerably higher in the field than the level of the tops of the

healthy plants, a fact remarked by almost every writer on the subject.

It will not be requisite to spend more time in refuting the mistaken opinions which have been promulgated; but we cannot pass over one which refers chiefly to rust.

5. *Influence of the Barberry Bush.*—In consequence of the leaves of the common barberry exhibiting a similar affection to the rust in corn, farmers, both in England and on the Continent, have concluded that the infection spreads from the bush in the hedge to the corn in the field; and this notion is sometimes strengthened from the rust appearing in patches and stripes among the corn, as if it had been carried thither by the wind from the barberry bushes.

Sir Joseph Banks, in mentioning this opinion, says, that "the village of Rollesby in Norfolk, where barberries abound and wheat seldom succeeds, is called by the opprobrious appellation of Mildew Rollesby." But though he himself speaks with doubt upon the subject, he does not absolutely discountenance the idea. (*On Blight in Corn*, pp. 10, 11.) M. Decandolle, in referring to this passage, says, he "would not have agitated the question, had it involved a plant less important than wheat, or a philosopher less distinguished than Sir Joseph Banks;" for it is most obvious to the slightest observation, that corn is often not at all infected even when the barberries in the vicinity are covered with their peculiar rust; and again, corn is frequently covered with rust when the adjacent barberries are quite free from it. (*Encycl. Method. Bot.* vi. 210.) A periodical writer remarks, that the rust in the ash, the elm, the barberry, the rose, the bramble, the coltsfoot, the nettle, the groundsel, the dandelion, and numerous other plants, "is as different in species as the plants themselves, and therefore it would be no less rational to maintain that a field of wheat would spring up if we should sow barberries, than that the rust growing on these should produce the corn-rust. Should it be said, that it is the difference of the nutriment of the fungus which causes the difference, I would ask, whether a difference of soil would produce rye or oats where wheat seed only had been sown." (*Paxton's Hort. Reg.* ii. 467.)

Ascertained cause of Smut, Canker, and Rust.—From the resemblance of smut to the powder contained in the well known fungus termed the puff-ball (*Lycoperdon*), it was conjectured by some of the early writers that it was identical therewith, not adverting to the great distinction of the two places of growth. Even the distinguished botanist Jussieu is reported to have said that the smut was caused by the globe puff-ball; and Sir H. Davy was led to adopt a similar notion from the resemblance of the smut and the puff-ball when chemically analysed.—*Agricult. Chemistry.*

The Abbate Fontana, in 1767, however, was certainly the first writer who had any clear notions on the subject, and his magnified figures in his excellent little work are as well calculated to prove his accuracy and to uproot popular prejudice, as the researches of his distinguished countryman Redi were to destroy the fancies about the spontaneous generation of insects by putridity, blighting weather, and similar vague and impossible causes.

But though this idea was so well developed by Fontana, and has since been elucidated by Bauer and others, the mode in which funguses grow and are propagated was very imperfectly understood, and one leading error on the subject is still very universally maintained, namely, that the growth of the funguses in question, as well as the attacks of insects on growing plants, must be taken only as a consequence of previous disease in the plants attacked. The truth is, that in the case of smut, canker, and rust, as well as in the case of all plant-lice and caterpillars, such as the hop-fly and wire-worm, *it is uniformly the healthiest plants which are attacked.* It is singular that such a mistake should in this instance have become popular, when in other cases, such as the attacks upon fruit made by wasps and birds, it is universally believed the best and finest are selected, though even this is not quite correct, for a wasp or a sparrow will more readily nibble at a wounded grape or a damaged jargonelle pear than at the best sound fruit on a tree.

Dutrochet's Discovery of the mode of growth in Funguses. —In a damp cellar where wine was kept, M. Dutrochet, one of

the most original observers of the day, remarked, about two or three years ago, a white looking net-work of fibres, which previous botanists (*Bulliard, Champignons Franç.*) had described as a species of crow-silk (*Byssus*). Being struck with its peculiar manner of growth, he watched it with careful attention, and got M. Turpin, probably the best botanical draughtsman in Europe, to take drawings of it in every stage of its growth. It would lead us too far from the object of this paper, to detail all his interesting observations. The general result was, that the supposed crow-silk was not as had been supposed of the genus *Byssus* at all, but the genuine stems, hitherto known as such, of a mushroom (*Agaricus crispus*, Turpin), the mushroom itself being the fruit only, and not as hitherto believed the whole plant. According to this view, then, it would be as correct to consider a bunch of grapes with their fruit-stalk a complete plant, as the fruits termed mushrooms, puff-balls, or puddock-stools, all these being only the fruits of plants generally growing under ground, in the form of small white or grey fibres of net-work, and termed improperly by gardeners *spawn*, indicating that it is the seed of mushrooms, whereas it is the genuine plants.

MM. Dutrochet and Turpin further discovered, that the seeds, or, as they are termed by botanists, *sporules*, consisting of minute globular bodies, are contained in the cells of fungus fruit in prodigious numbers, and they succeeded in observing these germinate and produce young plants like their parent. There cannot therefore remain a doubt, that funguses are produced from seeds in the same way as all other vegetables, though these seeds or sporules are exceedingly smaller than those of green plants—being as subtle, M. Fries remarks, sometimes as smoke.—(*Syst. Mycol. Intr.*)

Contrary, then, to what takes place with regard to the eggs of insects, which are too heavy to be carried about by winds, and if they were lighter, are generally, when laid, glued to the substances destined for the food of the young when hatched, the minute, light, subtle seeds of funguses and mosses are floated about in the air with the gentlest breeze, and in this way diffused over immense tracts of country, in numbers altogether countless. The discovery of M. Dutrochet is therefore

of the greatest interest in making us acquainted with the economy of Providence in the propagation of fungi, hitherto altogether mysterious.

What we term smut, canker, and rust, are, according to this discovery of M. Dutrochet, only the fruit of particular funguses, the plants of which they are the fruit being hitherto undescribed and unknown, but which must be sought for in the form of delicate fibres, probably transparent, and consequently difficult to see in the textures of the corn affected with these destructive parasites.

It forms no objection to this view, that the fibres of these funguses have not been seen except partially by Bauer and Ad. Brongniart in their microscopical researches, for M. Dutrochet further found, that when the fruit of the plant observed by him (*Agaricus crispus*), sent up its foot-stalks (*stipes*), it became partially detached from the main plant, and independent of it for its future nourishment, the fibres of the main plant indeed becoming exhausted of substance, and disappearing as may be seen in what were previously supposed to be the roots at the base of the fruit-stalk in the edible mushroom, which supposed roots are the fibres of the main plant, partly exhausted of their substance from nourishing the fruit.

Experiments of M. Fée on Parasite Fungi.—Before M. Dutrochet's discovery, an excellent cryptogamic botanist M. Fée tried some interesting experiments on the propagation of the particular sorts of fungi which are under consideration. M. Fée collected a number of leaves of the Burnet rose (*Rosa centifolia*) infected with the common rose rust (*Uredo Rosæ*), so as to be almost covered with it. He then took three rose-trees of the same species quite free from rust, and having planted them in separate boxes of mould, removed them from the vicinity of the rusty plant, taking care, however, to keep them in a similar aspect. He then mixed one part of the rusty rose-leaves, towards the end of winter, with the mould in the box of one of the rose-trees, reserving the remainder of the rusty leaves for another part of the experiment.

When the second rose-tree was in full vigour and near blossoming, some of the affected leaves were frequently shaken over the soil, in order to scatter the seeds or sporules, the re-

maining portion of which continued attached to the leaves. The rusty rose-leaves were afterwards steeped in water, and the third rose-tree was watered with the mixture during the spring.

Till the succeeding autumn, the time probably at which this fungus (*Uredo Rosæ*) naturally fruits, the three plants in the boxes exhibited nothing particular. At this season the tree in the box where the rusty leaves had been mixed up with the earth became profusely covered with rust, while the other two trees remained quite free. These two were, however, equally affected with the first in the autumn of the second year.

M. Fée infers from these interesting experiments, that the seeds or sporules of the fungi are sucked up with the moisture of the soil by the tips or spongioles of the root-fibres, and that the rust-seeds which in the first rose-tree in the box were mixed with the earth, came in contact with the spongioles before the opening of the buds, when the force of attraction being greater, they were more readily absorbed and developed than after the leaves and flowers have been formed, when the circulation of the sap is less active. At the period when fungi mature their fruit, the wind carries their seeds or sporules in clouds from place to place, while the rain precipitates them to the ground, and washes them into the soil. The viscid nature of these seeds or sporules when wetted with the rain, causes them to adhere to the root-fibres of plants, whence they are sucked up with the moisture of the soil, and carried with the circulating sap into every part of the plant.—*Annales Botaniques.*

Furnished with these sure scientific facts to build upon, we may now consider each of the three destructive species in their order.

1. *Ascertained cause of Smut.*—The parasitic fungus which causes or is denominated smut, is one of the genus justly termed brand (*Uredo*), but differs most distinctly, as we have already seen, from the canker-brand, by being without smell, and also in its mode of growth; for, while the canker-brand continues during its whole growth in the interior of the grain, the smut brand (*Uredo segetum*) at maturity bursts through the enve-

lopes of the corn, where it had previously lain concealed while it advanced in growth.

We have already seen that M. Adolphe Brongniart maintains, that the affection is chiefly, if not altogether, confined to the foot-stalk or peduncle of the grain; but he likewise deemed it necessary to investigate whether the powder of the smut should be considered as a modification of the tissues composing the peduncle when in a healthy state, or if it were formed in a manner different from its natural organization.

The spike-stalk (*rachis*), which supports the grains and the floral organs, in corn and grass plants, is formed of an extended cellular tissue, the cells being placed close to each other without any obvious spaces between them, and also of a congeries of vascular fibres, composed of cells very much elongated, of spiral vessels (*tracheæ*), and the intervals between them (*pseudo-tracheæ*). M. Ad. Brongniart found nothing resembling this structure in the fleshy mass occupied by the smut at any period, though he traced the affection to the earliest period when it could be distinguished. Even at the earliest stage, then, the fleshy mass in the foot-stalk destined to form the smut was found to be entirely composed of a uniform tissue, presenting cavities nearly four-sided, and comparatively of considerable size, separated by partitions formed of one or two layers of very small cells. These cavities, which resemble in structure the cells in reeds and rushes, were in the smutty ears filled by a compact homogeneous mass composed of very fine and minute grains, perfectly round, and all of equal size. They were of a greenish colour in the ear when scarcely unfolded, and slightly adhered to each other, though they were only connected by simple contact, being agglomerated towards the centre of each mass. In the ears more advanced in growth, these minute grains assumed a pale red colour. At a still more advanced period, the partitions of the four-sided cells disappear, the minute grains, instead of remaining in contact, become separated from each other, and the whole mass is transformed into a heap of dust, composed of very regularly formed round black grains, perfectly resembling the seminal germs of mushrooms.

It is evident, then, that there is no resemblance between the fleshy mass in the infected foot-stalk, or peduncle of the grain,

and the healthy foot-stalk, at whatever period it may be observed. Consequently M. Ad. Brongniart thinks himself perfectly justified in concluding, that the affection does not originate in any diseased modification of the natural tissues, but in the growth of a parasite fungus, whose progress he had thus traced more minutely than had hitherto been done, proving that no previously received opinion is correct.

M. Bauer appears to have performed experiments with smut somewhat similar to those of M. Fée with the rose-rust; but he has not given the details, having only published the results. He tells us he has ascertained, by repeated experiments of inoculation (how performed he does not say), that the seed of smut-fungus (*Uredo segetum*) is absorbed by the roots of the germinating seed-corn, and, being extremely minute, is mixed with and propelled by the circulating sap, which deposites it in almost every part of the cellular tissue of the plant. He adds, that he has not the least doubt that the seeds of the smut-fungus are shaken out by the wind, and that even many infected ears and plants are thrown on the soil of a field where infected corn has been growing, and that the smut fungi continue growing and multiplying on the soil till they become a part of it and cannot be distinguished.

These views we consider to be scientific and correct, except in so far as the fungi are said to grow on the soil, for this is not proved by observation, and it is probable, from analogy, that they would not grow except within the tissues of vegetating corn or grass.

2. *Ascertained cause of Canker.*—The canker or pepper-brand of wheat is proved to be a fungus of the same genus (*Uredo*) as the smut, but of a very different species (*Uredo fœtida*), well distinguished, as remarked above, by its smelling like putrid fish, and by its not bursting the grain, but remaining within the outer envelope.

The most minute account of the progress of the fungus is given by M. Bauer, whose investigations, however, were unfortunately previous to the discovery of M. Dutrochet respecting the vegetation of fungi. The earliest period, he tells us, at which he discovered the fungus within the cavity of the seed-germ (*ovulum*) of a young plant of wheat sown in November

was the 5th of June, sixteen days before the ear issued from the leaf sheath, and about twenty days before the sound ears springing from the same root were in blossom. At this early stage, the inner cavity of the seed-germ (*ovulum*) was very small; and, after fecundation, was filled with farinaceous substance destined to form the flour of the wheat.

It was then that M. Bauer first observed what he describes as the jelly-like *root* or *spawn*, rather the main plants of the fungi themselves, adhering to the lining membranes of the cavities, from which they could easily be detached in the form of small flakes. At this period, it is most important to notice that M. Bauer observed very short but distinct foot-stalks or pedicles seen issuing from the main plant, or what he terms *spawn*, and supporting the fruit. All the parts of the fungus are in the early stage pure white, but when the ear issues from the leaf-sheath, the seed of the wheat (*ovum*) is much enlarged, though still retaining its original shape, and the fungi (or rather we should say the fruit) multiplying rapidly, separate from the main plant, assume a darker colour, and lie loose in the cavity of the grain of wheat. The grains thus infected continue growing, the fungus producing within them a great number of fruit, till the period when the healthy grains attain maturity, and become of a light brown. Then the infected grains likewise change their dark green colour to a dark brown. When cut in two, the infected grains are found to be quite filled with the black grain-like fruit of the fungus.

By inoculating (in what way he does not say) the finest samples of seed-wheat, M. Bauer fully ascertained that the seeds of the canker fungus, adhering to the wheat, is taken up by the germinating roots, and carried by the sap to the younger ears, in the same manner as we have seen takes place with the smut-fungus. "Like a troop of sappers and miners," as Professor Burnet says, "the canker-brands carry on all their operations secretly, and often complete their work before its commencement has been suspected."

3. *Ascertained cause of Rust or Mildew.*—The rust and various sorts of what are termed mildew, are all caused by small fungi, such as the tuft-brand (*Puccinia graminis*, Persoon, or *Uredo frumenti*, Sowerby) and the linear brand (*Uredo linea-*

ris, Persoon, *U. largissima*, Sowerby), which do not differ so much in the injuries which they produce as in their mode of growth and appearance, as has been already described.

The history of the red rust need not detain us, as it has been long well known from the very good account given of it by Sir Joseph Banks, with most admirable drawings by M. Bauer. The opinion, however, which Sir Joseph seems to adopt is, not that the seeds of the rust-fungus get into the corn plants by the tips of the roots, but by the pores, on the leaves and stem being carried thither by the winds, and caused to adhere by the moisture of dew or rain. When once entered into the pores, he says —"They germinate and push their minute roots, no doubt (though these have not yet been traced) into the cellular texture beyond the bark, where they draw their nourishment by intercepting the sap that was intended by nature for the nutriment of the grain. The corn, of course, becomes shrivelled in proportion as the fungi are more or less numerous on the plant; and as the kernel only is abstracted from the grain while the cortical part remains undiminished, the proportion of flour to bran in blighted corn is always reduced to the same degree as the corn is made light. Some corn of last year's crop (1804) will not yield a stone of flour from a sack of wheat; and it is not impossible that in some cases the corn has been so completely robbed of its flour by the fungus, that if the proprietor would choose to incur the expense of thrashing and grinding it, bran would be the produce, with scarce an atom of flour for each grain."—*On Blight in Corn.*

Prevention of Smut, Canker, and Rust.—Although the ascertainment of the real causes of the destruction of corn, which we have been considering, does not advance our knowledge so far as could be wished of the means of prevention, it teaches us the almost equally important lesson, that many things vaunted as preventives must be totally inefficacious. If M. Bauer's opinion indeed be correct, as it appears to us to be, that the seeds of the smut-fungus, each plant of which, according to the high authority of M. Fries (*Syst. Mycol.*), produces upwards of ten millions of seeds, are scattered on the soil where the smutted corn grows,

lying in wait to attack the next crop the instant it germinates, no preparation of the seed-corn before sowing can be of the slightest use. The only likely means of clearing a field thus infected would be paring and burning the soil; or, supposing all or most of the smut-seeds to enter the roots of the next crop, to sow a thick crop of corn and cut it green for cattle, or plough it down as manure, before the funguses arrived at maturity to again scatter their seeds. An abundant liming of such a soil might also prove advantageous, from the lime, while in a caustic state, burning and destroying the seeds.

It is upon the latter principle that M. Bauer recommends the steeping and washing of seed-corn in lime-water, endeavouring to cleanse the corn so effectually that every particle of the fungi and their seed be entirely removed from the grains; "but," he adds, "as these extremely minute fungi, when once mixed with the seed-wheat, insinuate themselves into the grooves at the backs and the beards at the tops of the wheat grains, I think *it is almost impossible to dislodge them by washing*. I once received some samples which had been so prepared and washed in salt-water, and declared to be perfectly clean, but on my putting some of these purified grains into water in a watch-glass, and leaving them to soak about twelve hours, on bringing them under the microscope I found many of the fungi floating on the water."

The lime-water acts as we have seen by destroying the vegetative power of the seeds of the smut, canker, or rust, and it will thus kill such seeds as may be attached to corn by steeping it for twelve hours in strong lime-water, and afterwards drying it before it is sown. In large quantities of corn, however, it is not likely that even by this method all seeds of the fungi can be destroyed, and it will not of course have any effect on those seeds which are already scattered in the fields about to be sown. M. Bauer found, by repeated experiment, that such steeping in lime-water does destroy the vitality of the seeds of both smut and canker in seed-wheat. In oats and barley, the kernels of which are so tightly enclosed in the husks, the lime-water cannot readily penetrate, and consequently the steeping of these is not likely to be so effectual.

It will not be necessary to mention other steeps, many of

are as much calculated to injure the corn as the fungi; : may be necessary to state, that among the numerous ırative experiments with various steeps which we have ed, we do not recollect one of the least value to found an nce upon. They are all vague and inaccurate, from the ne causes not being well understood. Experiments on this :t, to be worth any thing, must have the seeds of the ıses actually brought into contact with the roots and other of corn-plants at different stages of their growth. Above t is important that these artificially infected plants be ı in soil carefully freed by fire from the chance of con- g fungus-seeds, as well as to have the corn-plants so en- l by glass, or otherwise, that the seeds of the fungi might e brought to them by the winds. All experiments of this performed without such precautions, by sowing patches in l with sound, infected, or steeped seed-corn, are worse than less, as the results cannot be otherwise than fallacious.

ON THE AGRICULTURE OF HINDOSTAN.—NO. I.

—— Plants divine and strange,
That every hour their blossoms change,
Ten thousand lovely hues!
With budding, fading, faded flowers,
They stand the wonder of the bowers,
From morn to evening dews. WORDSWORTH.

THING can be conceived more erroneous than the ideas ally entertained, regarding the aspect, physically consider- ' the great Indian possessions, which have been acquired reat Britain. Some have formed their pictures from the ıtic legends and stories peculiar to the East, where rivers ade to roll over golden sands, where flowers are breathing nial fragrance, and where palace, mosque, and minaret are abitations of princes and of priests. Others, from a course newhat more authentic historical reading, have formed for elves greatly exaggerated notions of the wealth, pomp, and dour of the Rajahs; while not a few, whose maxim on most s is, that "seeing is believing," have convinced themselves e grandeur of Hindostan, not by legend or by written re-

port, but from a knowledge of the unequivocal circumstance of so many of our countrymen having left the North, poor, and returned from the East, rich. When we penetrate into the interior, we doubtless meet with many architectural remains of former magnificence and luxury. The caves at Ellora, at Keneri, and at Elephanta, hollowed out of the rocks, are among the most magnificent and stupendous monuments of human toil, and their elegance and regularity leave no doubt behind, that, even in the early ages of their excavation, the principles of architecture were understood, and generally practised among the Indian nations. The remains of Aurungzebe's palace at Aurungzabad, and the unparalleled fort of Doulutabad, yet speak to us in their decay, of what Hindostan was, when the greater part of Europe lay buried in the night of barbarism. Nor, in our day, are the three great coast-towns of Calcutta, Madras, and Bombay, insufficient to sustain in the mind of the visitor any preconceived ideas of oriental magnificence. From possessing the great government offices, and being consequently the residence of many of the wealthiest English gentlemen and merchants, the first combines European taste with Asiatic grandeur, while the last, in a style perhaps still more picturesque, exhibits the varied costumes of its various inhabitants—British, Armenian, Arab, Jew, Portuguese, Chinese, Rajpoot, Mogul, Mussulman, and Hindoo. But when we turn from these, and passing the suburban village quietly progress into the vast territory which has been subjugated, as it were, by one spell, only to be kept in subjection by another, we find ample reasons for lowering the tone of our speculations. Instead of the pomp and parade, distinguishing the chief seats of the British Government, the eye will rest only on the depraved, the dependent, and miserable natives of the Deccan, and on dwellings almost too paltry for the habitation of human beings; in short, little elevated above those of the Esquimaux or Laplander. Even the abode of the Bramin, and of the more wealthy class, is generally built of mud, with a flat roof, and without windows. Let us take Mr Graham's description of these domiciles, as it is at once concise and graphic.

"The form of the building is generally square, with an open court-yard in the centre, to receive the cattle. Towards this court-yard, the house is

open, the roof on that side being supported, not by a solid wall, but by wooden posts placed at certain distances. From the street or lane of the village, nothing can be known of what is going on within the precincts of the little court-yard and house, and nothing can be seen but a high mud wall, and strong door, admitting the ingress and egress of the people and cattle.

Should the stranger look within the door, the whole family will be thrown into the greatest commotion; the females will conceal themselves in the farthest chambers; the head of the family approaches, remains silent, yet seems determined that the stranger shall not advance to defile his cooking-place, round which are several bright brass pots. Nothing is to be seen which, in the English sense of the word, may be called furniture. If the stranger enter the hut of the common cultivator, he will find the alarm of the natives much less; the door is so low that he can scarcely enter, and when he has reached the interior, it is full of smoke—such a thing as a chimney has not yet been thought of. Near the cooking spot are piles of common earthen pots, containing salt, onions, and red pepper, and old bags or dirty cloths with spices. In one corner stands the large basket, containing the family grain, and on the floor are the two stones for grinding the daily allowance of meal, near which naked children are crawling up and down. It is impossible to stand upright without danger to the head, against the cross sticks, which support the flat roof. Opening from this room, is another—the family sleeping-apartment. Here all is pitch dark, and the beds are lying on the ground. The stranger will now be glad to reach the pure air outside, where he may observe the rude Hindo implements of husbandry, not in use, lying at the door, and see the cultivator's lean, worn-out bullocks, which have been toiling all day, eating their scanty allowance of provender for the night. It will be long ere a stranger can learn the real feelings of such people. Fear still rules over them. But through much kindness and long-continued intercourse, they will at length express their sentiments of the Government, and will say that 'We have, indeed, still peace and security under the British, but are fast becoming a nation of beggars.'" *

Let us add to this, that each of these miserable farm-steadings must pay its yearly land-tax to the government; and then the grandeur and luxury of the Indian capital will be looked upon in a different light, when we feel, that by far the greater portion of it must be consequently wrung from these poor and humble cultivators of the soil.

Having alluded to the Hindoo implements of husbandry, we may here mention how rude and simple these are. Their light plough is made of a sharp pointed block of hard babul wood, or Egyptian thorn, with a pole in front, at whose extremity is a

* Vide a small but valuable essay, entitled, "Means for Ameliorating India, deduced from personal observations," &c. By Archibald Graham, Surgeon, H. E. I. C., Bombay Establishment. Glasgow, 1835. Pp. 24–7.

cross-beam to be laid across the necks of the oxen. The construction of this rude, simple, and most inefficient machine, than which nothing could be meaner as to mechanical design, is completed by a single erect handle fastened to the other extremity of the block. By means of this it is guided through the soil, which it would be libellous to say that it ploughs, as it merely stirs the surface to the depth of three or four inches. During the progress of the crops, they are carefully watched by men and boys, who throw stones and crack whips to scare off the flocks of birds; and when fully ripe they are plucked up by the roots. The highest piece of ground is selected for the thrashing floor, and the grain is here deposited in a large semicircular heap. The women then commence twisting off the heads, which they throw on the ground, and when a sufficient quantity has been thus treated, the bullocks, with their noses muzzled, are fastened in a row to a post in the centre; and, being driven round and round, are thus made to tread out the grain with their hoofs. The method of winnowing is quite in keeping with these preceding operations. It is performed by a person who, standing on a high bank, lets the grain fall gently through his hands—experience having settled the question of the grain being likely to seek the ground from its weight, while the chaff from its lightness disappears upon the wind. Millers being unknown among the Hindoos as a separate occupation, each family grinds its own meal, by rubbing the grain between two stones.

Besides this light plough there is, however, another one used for the black soils, which is necessary for productive purposes to turn up to a depth of at least fifteen inches. If the implement used be imperfect, it must be acknowledged that the labour bestowed on the operation is great, as this ploughing is repeated four or five times in different directions during the same season before the hot weather sets in. Several harrowings are, besides, necessary to break the clods, and lastly, a transverse beam is passed over all, in order that the surface may be properly smoothed for the reception of the seed. "To effect this deep ploughing," says Mr Marshall, in his excellent Statistical Account of the Pergunnah of Padshapoor—

"A heavy and consequently a clumsy plough, and a team of four or sometimes five pairs of the strongest cattle (generally buffaloes) that can be mus-

tered are used. Nothing can be much ruder or display less mechanical skill than this plough, the mode of harnessing the cattle to it, and of keeping the machine in motion. The plough itself consists of a heavy, three cornered block for a share which has a constant tendency to drive deeper into the earth, and to make the hinder part of the instrument to which the handle is affixed tilt up. The piece which forms the breast of the plough leading from the broad part of the share to the bar or rather beam, to which the hinder pair of cattle is harnessed, is placed at such an acute angle as to be constantly choked with the earth moved by the share. The bar is at least twelve feet long, and its extremities are level on the necks of the rear, or strongest pair of the team, who, by this length of lever, have great power given them to move the plough in every direction but the right one. They are parallel to, and at some distance wide of the plough, exerting their strength not in drawing, but in pushing, and the least inequality either of the exertion or of the resistance twists the plough out of its course, and all the efforts of the harassed ploughman are insufficient to maintain any thing like a straight line. The remaining pairs of the team draw, and are yoked on each side of a long rope, harnessed into small cords of the most fragile fabric. On the yoke of the third pair from the extremity sits a lad, with his face towards the plough; he is armed with a strong leathern whip, with which it is his business to animate the pair, on whose neck his immediate seat is, as well as the pair beyond, to effect which he is of course perpetually obliged to change his front, and it must be allowed he displays much dexterity in the revolution. The charge of the foremost pair is committed to an old man, who generally takes his place quietly in the front of them, and walks backwards, dragging on a bullock in each hand by a small halter: he of course cannot contribute much to preserving a right direction."*

Mr Marshall then informs us, that he has repeatedly conversed with the cultivators on the inordinate depth of their ploughing, and on the glaring imperfections of the instrument which they employed to effect it, but his answer was, with regard to the first point, that without this very laborious operation there would be a total failure of their crops—a decisive objection if correct. In reference to the second, he found that the introduction of a better constructed plough would be very difficult, from the great scarcity of capital, as well as from the want of skill, alike in the artizan to fashion, and the ploughman to use it.

Their drill machine is worthy of remark, not only as indicating more contrivance, but as being somewhat better adapted for accomplishing the end in view.

* Statistical Reports of the Pergunnahs of Padshapoor, Belgam, Hoondgoone, &c. &c. in the Southern Mahratta country, by the late Thomas Marshall, Surgeon, B. E. folio. Bombay. 1822.

"It appears rude," says Mr Graham, "but is well suited from its great simplicity for sowing their grains in rows. It consists of three or four small hollow bamboos, which are about four feet high, and fixed into a large wooden bowl or cup. Near the ground each passes through a bar of wood, at the distance of about a foot one from the other. After passing through this, they run obliquely forward, and are shod with iron at the point, behind which the grain drops into the ground. The machine is drawn forward by a pair of bullocks, which pull from a beam running forward from the bar. The man goes behind driving the bullocks, and feeding the cup from a bag tied round his waist. A large iron scraper fixed in a bar or beam of wood, is often used instead of ploughing by the Hindoos. It penetrates the ground to the depth of three inches, and destroys all the weeds, to remove which, a harrow, with three or four wooden teeth follows. They clean the ground by means of a crescent-shaped beam. When the blade is low, this allows the row or line of the grain to escape in the middle, while a small iron scraper on each end of the beam clears the interval betwixt the rows of all weeds, loosening the soil, and throwing it gently up against the roots of the growing wheat. Their plan of sowing other products along with their grains might be worthy of consideration."*—Graham, p. 77, 78.

When this is the object in view, a supplementary pipe, and another assistant is necessary. One of the apertures in the cup is closed, and from the lower part of its corresponding bamboo passes a cord five or six feet in length, to the opposite extremity of which is tied the additional bamboo, which projects far behind, and is kept erect by a lad, who holds it by a string fastened to his left hand, while with his right he keeps feeding it with the separate grain. The lower end of the bamboo passes through a small block of wood, which is just long enough to permit its edges to rest on the sides of the furrow, which has already been made by the vacant bamboo of the drill machine.

The harrows of the Hindoos are of two kinds—one like the small plough adapted to the red sandy soil, the other like the great plough to the black. The first consists of one bar of wood five or six feet in length, through which are driven about six stout iron tines or spikes, projecting about eight inches. From the centre of this bar proceeds a bole, strengthened by a cleat on each side, and fastened to the yoke of the bullocks, of which two pairs are generally employed. The driver of the rear pair sits on the cleats, and his weight adds to the power of the instrument, which is, however, still inefficient from its lightness for breaking up the large clods of the black soil in which it is used, and is mainly useful in raking up the myriad roots of weeds dislodged by the plough. Mr Marshall thinks that this harrow

would be much improved in power were it extended backwards in a succession of bars like the English harrow, of which it may be said to be just the front bar. The other implement, which is named Okar, is adapted only for the very lightest soil; and has merely a few blunt wooden teeth, and no iron tines. In fact it cannot be considered much more efficient or powerful than our common garden rake.

An instrument named Kolpee, and a most useful appendage to the drill husbandry, is used for the first and second weedings of the plants, and this is done before they have attained any great height. In principle it entirely resembles the English horse-hoe, and consists only of two shares or spuds, one at each extremity of a crescent-shaped frame, the arch of which passes over the row of corn, whilst the shares move the earth between the rows, uproot the weeds, and raise the soil to the roots of the plants. In performing this operation the bullocks are always muzzled. After the plants have grown too high to allow of the use of the kolpee, two other weedings are generally required, especially with regard to the more valuable crops. These are done by the hand; women being generally employed for the purpose, armed with a small spud, which they learn to use with great dexterity and adroitness.

We have only to mention another agricultural implement, which is called Kurub, and in its formation is nearly the reverse of the hoe. It consists of a stout and somewhat crescent-shaped knife, the cutting edge turned forward, and the ends fixed in stout wooden cheeks. It passes very near the ground, and is used for cutting up stubble and the stronger weeds. It is used shortly after the gathering in of the harvest.

In many parts of India wheel carriages are not at all in use for agricultural purposes. The manure is carried out to the fields in baskets, on the heads of labourers, and the grain is brought home in bags slung over the backs of cattle. The straw, which is fastened up into bundles, is trailed home behind the bullocks or buffaloes. It is not that wheel-carriages are not equally applicable to those parts of the country where they are not used, as to those where they are, but habit in a Hindoo becomes a kind of second nature, which even the demonstration of the most unequivocal benefits has been found insufficient to overcome.

The manure in common use throughout India, consists of the dung and litter of the cattle, which are carefully collected, fire-ashes and house-sweepings, fallen leaves, and decomposed vegetable matter. All this is reduced into a state approaching to pulverization before it is applied to the soil, which is done in indefinite quantities, but all that can be collected is invariably used, and made to go as far as possible. It must not be omitted, however, that all animal matter is carefully excluded from their dung-heaps, which they will not suffer to be thus polluted. After being scattered over the soil, it is afterwards incorporated with it by means of the small harrow.

With reference to the soil of India, it is somewhat remarkable that such a vast tract of country should exhibit so very few varieties. Throughout the whole of the immense plain of the Ganges, the prevalent soil is a rich black mould, of alluvial origin, nor will any substance so coarse as gravel be found either in the Delta, or nearer the sea than Oudanulla, which is distant from the river more than 400 miles. From the beds of the streams being of clay, it is probable, however, that the original soil was of that nature, and this liklihood is almost proved from many parts of Bengal and the adjacent provinces still exhibiting a clayey surface. The soil of the Malwah, as also that of the Punjaub, is equally fertile with that of Bengal, and is composed of nearly the same rich dark mould. The soil of the Deccan and of the southern provinces is of course various in its qualities, but in general it is a fertile loam on rock. Towards the coast it is poorer and more sandy. The substratum of the soil in Hindostan Proper is in many places calcareous, and in some of clay or rock. In the province of Malabar, the soil between the foot of the low hills intervening between the sea and the Ghauts, is a thick earth or red clay. Rocks of trap formation, sandstone, and quartz, are seen in Malabar; the summits of the Eastern Ghauts are of bare granite, while in the Western chain much limestone and basaltic rock is to be found.*

In treating of our subject, we would be generally understood as making our remarks bear on what may be termed India

* The geological reader will find much valuable information on this subject especially on the strata between Malwah and Guzerat, communicated by Captain John Stewart, in the Transactions of the Literary Society of Bombay. Vide vol. iii. [illegible] 16

Proper, meaning by that appellation the immense plain extending from east to west between the Brahmapoutra and the Indus, and stretching across from the great mountain chain to the Southern Peninsula. Its length may be about 1500 miles, and its average breadth 350; and for fertility, if we perhaps except the region watered by the great river of China, has no equal on the surface of the globe. Without reference to allies and tributaries, it is amazing to think of the population of British India. The Bengal presidency consists of 328,000 square miles, and contains fifty-seven millions of inhabitants; the Madras presidency 154,000 square miles, and fifteen millions of inhabitants; and the Bombay presidency 11,000 square miles, and two millions and a half of inhabitants, independenly of the territories acquired in the Deccan since 1815, comprehending 60,000 square miles, and eight millions of inhabitants, making a sum total of 553,000 square miles, and of eighty-three millions of inhabitants. The population of the tributary states, according to Mr Hamilton,* amounts to forty millions, giving thus the enormous amount of one hundred and twenty-three millions of souls under the immediate government or direct influence of the British empire.

The whole of the vast plain to whose agricultural state we mean to direct the attention of our readers, may be said to be in a state of cultivation. The original productions of nature have been effectually rooted out, and the plants and grains fitted for human use have been substituted, except in the few districts where political misrule has been paramount, or where the power of vegetation, from the combination of heat and moisture, has been found even greater than that of man to control it. The principal staples are rice, sugar, cotton, opium, and indigo; we shall refer to the cultivation of these separately, and also of the introduction of other products which seem fitted for the soil and climate of India.

* Indian Gazetteer, vol. i. p. 36. The estimate of Mr Wallace is nearly similar. Humboldt (Personal Narrative, vol. vi.) is considerably lower, but he does not include Ceylon or the Isles. The estimate published by Parliament in 1832, is even higher than that we have adopted, making the population of British India Proper, 89,470,152, of the allied or protected, 40,000,000, and of the still independent 11,000,000. Giving thus to India a population of 140,000,000.

We must premise the remarks on these, however, with a few observations referring to the Indian seasons of seed time and harvest, and to the productiveness of the soil.

In the month of Jesht, corresponding to the latter half of May, and the earlier part of June, are sown Til (*Sesamum Orientale*), Ooreed (*Phaseolus Max*), Mukka (*Indian Corn*), which is never permitted to ripen, Natchenee (*Cynosurus Coracanus*), the Ragee of some districts, where it is highly prized, and Rala or millet. All the plants of this class are of rapid growth, and ready for gathering before the end of the rains.

The month of Ashar, or that succeeding Jesht, when the first heavy rains are supposed to be over, is, however, the principal sowing season, and the seeds then sown take six months to ripen, constituting what is termed the Khureef harvest. This is the seed time for the rice, the great staple of Indian dietetics, for the Joaree of Guzerat (*Holcus Sorghum*), for the Bajra (*Holcus spicatus*), for the Toour, or Dal of the English, for the Mut and Moong (*Phaseolus aconitifolius, et Mungo*), for the Koolthee and Paoota (*Dolichos biflorus, et Lablab*), for the Juwus or Lintseed, for the Tag or Bengal Hemp, and the Umbaree (*Hibiscus Cannabinus*).

The third class is sown in Aswin, or the Hindoo month, comprehending the latter half of September and the first half of October, and require little or no rain for bringing to maturity. It consists of the Hurburee or Bengal Gram; the Kupas of Guzerat, or cotton (*Gossypium herbaceum*); the Erund or castor-oil plant; the Tambakoor or tobacco plant; and the Safflower (*Carthamus tinctorius*), or Koosum Ba of Guzerat, where it is cultivated principally for the fine crimson dye of its flowers. The varieties constituting this class require from four to five months for the perfection of their produce.

As to the quantity of produce from an Indian farm, we cannot do better than quote the following sensible remarks of Mr Marshall, ftom his Statistical Report of the Pergunnah of Padshapoor:

"It is under any circumstances," he says, "a matter of great difficulty to make an estimate on which any dependence can be placed, of the quantity of produce from an Indian farm. It becomes still more so, where it is the custom to intermix different sorts of produce; and, where there is no definite and measure the attempt seems altogether vain. The proportion of the

quantity gathered to the quantity of seed sown, even if correctly ascertained, teaches very little, as it depends far more on the individual properties of the plant in question, than on the fertility of the soil. A head, for instance, of Joaree or Surgurm contains commonly 400 or 500 grains, and in a remarkably fine one 2000 have been counted; whilst a pod of Hurpuree has only two seeds, and a whole plant perhaps six or eight pods; therefore, unless the relation between the quantity of seed and of produce in each species, being compared with that of the same species in some other previously described district as a standard, it affords no information whatever, or at least none of any use."

Notwithstanding the general hard labour to which the cattle are subjected, these animals are generally in tolerably good condition, the hill-sides affording abundance of grazing, and the superabundant straw of the grains, more especially of the Joaree of Guzerat, affording plenty of horse-fodder. The British Government have found it necessary to pay some attention to the improvement in the breed of bullocks for the use of the Ordnance department, but as yet only two districts in the Bengal Presidency, the Purneah and the Sarun of Bahar, have succeeded in producing animals of the size requisite for that purpose. In the neighbourhood of Surat and in Ceylon, there is a breed of bullocks scarcely larger than mastiff dogs, and a stinted breed both of kine and buffaloes seem to prevail on all the western border of the Deccan, at least as far north as Poonah itself, where the fine large milch buffaloes of Mahoor, and the superior caste of Malwar bullocks are common; but it does not appear that either breed becomes naturalized, and considerable annual importations are necessary. As just mentioned, the bullocks of the Purneah district are much superior to those in the lower districts of Bengal; they are of a large size, well formed, strong, and active. The sainted species of the ox are very handsome animals, and are known from the European breed by the fatty protuberance on the back. It is the zebu, or Bos Indicus of naturalists, is of a white colour, small size, active habits, and has large perpendicular horns.* The buffalo abounds throughout the southern districts of India, and are of great use in agriculture from their size and strength. The species called Arne, found among the

* Mr Ward, in his account of the Hindoos (vol. i. p. 249), informs us that persons strict in their religion, worship the cow daily; and that an annual festival is celebrated in her honour. Brahma is said to have created the Brahmins and the cow at the same time, and *Prowie* is termed the mother of the gods. Soon may the daylight of pure Christianity dispel the nightmare of such illusory dreams.

Ghaut, as well as the Himalaya mountains, are said to be full six feet high, having horns of enormous length.

Mr Marshall is decidedly of opinion, that a superior breed, both of bullocks and buffaloes, for draught purposes, might be introduced into most of the districts, but there is great difficulty in overcoming the established habits and prejudices of the natives. He mentions the male buffalo of the Surat breed as an animal of nearly double the size and strength of those in common use, but is not aware that it has ever been yet trained to domestic purposes. He regards it as a considerable obstacle, however, to the introduction of new breeds of cattle, "that in the kinds in which the animal of one sex is particularly valuable, it by no means follows that the other would be endowed with corresponding good qualities. We never hear of the abundance of the Malwar cow's milk, whilst the excellence of the bullocks for draught is proverbial. The male of the Guzerat buffalo is esteemed of so little use, that the greater part is not even reared. The males of the Mahoor breed are so fierce as to be useless except for purposes of propagation." *

We need scarcely remark that, for purposes of grazing, the districts bordering upon the hilly country have decided advantage over the level districts, where nearly the whole surface is submitted to the plough. In the latter, during the three concluding months of the fair season, the cattle are seen to fall off miserably. There is no out-of-doors fodder, and were it not for the house provender, a great proportion of them would necessarily die.

Of the horse comparatively little use is made in India, except for the purposes of riding, although the moderation of the climate, the constant supply of running water, and the abundance of grass, would appear to mark it out as excellently adapted for horse-breeding. The native horses are small, ill-shaped, and exceedingly vicious. Some of the Bengal breed are little larger than mastiffs. In the mountainous districts of Nepaul, although not much larger, they are very active and handsome. The Mahratta horses, such as were in use for their cavalry "are very scrubby," to use the words of Mr Pennant, but active and swift.† The Tattoo horses of Bengal are about ten

* Statistical Report of Padahapoor, p. 13. † Pennant, vol. i. p. 41.

hands high, rather slight in make, but strong and vigorous. The breed known as Tox-keys and Tagees are from fourteen to fifteen hands, are supposed to be a foreign breed naturalized, and are fit for draft or saddle. Great numbers of Tatarian horses are sent to the annual fairs of Caubul, and are thence dispersed over the northern provinces of India.

"In that part of Behar which borders on Nepaul," * says Mr Condor, "a great number of horses are bred for the British cavalry; and since attention has been paid to the breeding of them in this part, many of the very best qualities have been reared, particularly in the districts of Tyrpoot and Hajypoor; and they are in such request, that horsedealers from Upper Hindostan frequent the fairs at Hurdwan and other places, to purchase them. The British Government frequently obtain excellent horses also from Lahore, and from some districts in Guzerat."†

Of the Indian dairy we have not much to say. The cows are bad milchers, nor can this be remedied except by improving their food. What falls to their share is generally very scanty, and consists in a great measure of broken straw. The first cross with an English bull has been observed considerably to remedy the defect alluded to, but we must add, that these being favourites, it is not unlikely that more attention is paid to their feeding. It seems also ascertained that the cross between the English bull and the country cow has proved preferable for milk to that between the English cow and the country bull. The quality of the milk from the native cow is rich, and produces a sixteenth of its weight of butter. As a proof of its nutritive qualities, we need only state, that the calves keep in good condition upon it, although it rarely exceeds three quarts per day.

"The bull," says Mr Gibbon, in his excellent account of the state of agriculture in Behar, "is consecrated, and is permitted to feed at large, and it is probably owing to this more than to any other cause that the breed continues so perfect under circumstances approaching to starvation. The breed will increase in size with the improvement of their food, and they have been found to degenerate when the larger breeds from the north are taken to the south side of the Ganges, where there is less pasture. When these animals become old, one rainy day, in the cold weather, will leave the fields strewed with hundreds of them, not being able to resist at once the united attacks of age, of cold, and hunger."

* Modern Traveller, India, vol. i. p. 76.

† According to the letter of the celebrated traveller Burchardt, which was given in the end of our last volume, it appears that numbers of Arabian horses are imported into Western India from Bagdat; and many of the settlers in New South Wales now breed largely for the Indian market.

It is on the buffalo that the natives chiefly rely for their supply of milk, a good one yielding ten seers at two milkings, and of a quality richer than that from the cow. This is known from its producing a greater quantity of butter, which when melted and clarified is called ghee, and is only in that state made use of by the people. The butter is made from the whole of the milk, churned after it has become sour and thick, and being softer and whiter than that from the cow is consequently more esteemed. When in the state of ghee,* and properly clarified, it has been known to keep free from rancidity considerably over twelve months.

Cheese has been made both from cow and buffalo milk, but the practice is a rare one. It is generally curdled with kid rennet. About twelve years ago some of an excellent quality was made at Hansi in Behar, and "this encourages the hope," says Mr Gibbon, "that it may be made everywhere else."

We may farther remark concerning the buffalo, that the males are quite neglected, and the greater part of them thrown away at their birth. The few spared from compassion have a small quantity of milk allowed them until they are able to pick herbage, after which they are left to shift for themselves. When grown up they are sold for from two to four rupees; and in the month of September hundreds of them are sent to Dacca and other places for sacrifice. They are never castrated. In Southern Behar the male buffalo is used to prepare the paddy lands, their surface being at that time covered with water, and the object is to form a thick mud by stirring with the plough. He is very susceptible of heat, and when he gets overpowered, the ploughman cools him by throwing water over him.

The buffalo cannot bear the heat of the sun so well as the ox can, nor does he possess the same activity of motion. When we compare them together it must be allowed that the former exhibits greater strength; but he cannot exert it so long as the ox can, and as a labouring animal is consequently held in less esteem. Nothing, however, can match his docility, and he be-

* Ghee is made of butter, which has been kept for two or three days, when it becomes rancid. It is then melted in an earthen pot, and boiled till all the water has evaporated; after which it is poured into pots or leathern jars, and kept for use.

comes thoroughly domesticated. He obeys the call of his keeper, is manageable by the smallest child, who will sometimes be seen sleeping on his back when grazing or ruminating; and it is even said that he has rushed to the defence of his master when attacked by wild beasts. He is satisfied with the coarsest herbage —the grass used for thatching, or the half dried leaves of the *Palma Christi.* The beef of the buffalo has never been fairly tried, the females are too valuable to be killed, a good one being worth twenty-five rupees, and the male never being either castrated or fed for the market.

The sheep of India can scarcely be regarded in an agricultural point of view. A shepherd is occasionally paid to allow a few sheep to be kept on a field in preparation for poppy, or when the seed of paddy is sown before being transplanted, but the idea of cultivating a green crop with the intention of feeding it off to manure the land, or for the purpose of improving the soil, never entered into the brain of a Hindoo agriculturist. This and many other things furnish subjects of future experiment for our eastern empire. Goats are still held in India in greater estimation than sheep, and although the prejudice is still strong against the latter, in process of time this may wear off, for self-interest opens the eyes to many things which have seemed fixed and permanent from long established custom. A fed sheep seldom weighs more than ten pounds a quarter; and the fleece shorn twice a-year weighs about half a pound.

The breed of sheep peculiar to India, and found all over it, except towards the extremity of the Peninsula, is covered with hair of an extreme silkiness, instead of wool, and is also distinguishable from the European by the reverted horns. The true Cashmerian sheep, a delicate animal, furnishes the fine wool used in the manufacture of shawls; and in Moultan, the *Chara* or thick-tailed sheep are also found. The Thibet sheep is prized for the quality of its wool, and only the interior or shorter hair is made use of; and in Assam the rams have four horns. In the mountainous districts the wild sheep is not uncommon; and both Guzerat and Cutch abound with goats wild and tame. According to Pennant the shawl-goat of Cashmere is "characterised by smooth horns, with a single spiral twist, and between them a long tuft of white hairs; face white, bound-

ed lengthways by a dark line; cheeks pale red; hind part of the head and neck, fore part of the throat, and the beard white; rest of the hair black, all very long, straight ears, white and pendant."*

As to the hog we need hardly take him into account at all. There seems a general prejudice throughout India against him, however carefully fed. Even Europeans give in to this. The animal never becomes perfectly domesticated, and does not thrive well when pent up. Mr Gibbon mentions one that, having escaped from a sty, was permitted to range in a sugar cane field for three months, and became perfectly wild.

So great is the attachment of the hereditary cultivators to the soil, that it seems to have become an inherent part of their nature. In his admirable memoir of Central India, it is mentioned by Sir John Malcolm, that, in the last thirty years of intestine trouble, when so many villages were desolated, the scattered inhabitants still cherished the memory of their ancient homes with affectionate ardour; corresponded with each other, however widely separated; intermarried, and upheld by every possible means the remembrance of their ancient connexions and hereditary titles. On the restoration of tranquillity, they all returned to their respective villages, and without dispute resumed their ancestral lands. "Infant Potails," says Sir John, "the second and third in descent from the emigration, were in many cases carried at the head of these parties. When they reached their villages every wall of a house, every field, was taken possession of by the owner or cultivator, without dispute or litigation between themselves or the government; and in a few days every thing was in progress as if it had never been disturbed.†

The communities of Hindostan are held together by a peculiar system, which, although considerably behind those of Europe in moral refinement, is yet a curious admixture of law, custom, and religious ceremony. The great mass of the natives are cultivators of the soil, which they hold by tenure of an annual rent, generally a sixteenth of the whole produce, payable to

* Pennant's View of Hindostan, vol. ii. p. 242.

† A Memoir of Central India, including Malwa and adjoining Provinces, with the History and copious Illustrations of the Past and Present Condition of that Country. By Major-General Sir John Malcolm, G.C.B., K.L.S. 2 vols. 8vo. London, 182[illegible]

their immediate superiors, by whom, again, a tax is paid to Government. The country is divided into districts; these districts subdivided into villages. Each village forms an independent association of agriculturists, with its own establishment of officers, who, for certain duties to be performed, have a tithe of the produce, or a portion of land. These offices are generally hereditary. The cultivator's interest in the soil is hereditary also.

The officers of the village are the Potail, or head man, who is the organ of communication with Government, the collector of the public dues, and sometimes lessee of the village,—the Bullaye, a sort of constable, who, from his acquaintance with local rights and boundaries, gives evidence about disputed land-marks, —and the Putwarry, or register, who keeps accounts of all village matters. As with ourselves, the priest, the watchman, the carpenter, the blacksmith and the barber, may also be considered as public characters.

These village communities are connected by various links with the general officers of the district, and thence with the Zemindary, who is usually a great functionary of Government, and by whom, under the Mogul dynasty, the land-tax was finally paid into the royal treasury. A general system of magistracy and police is thus formed, which is consecrated by immemorial usage in the minds of the population; and which, although sometimes perverted to improper ends, has been found far from ineffectual in maintaining the tranquillity of the country. Knowing, therefore, as we do, that among no people on the face of the globe does such bigotry to established customs so inveterately prevail, it would be well for the British Government to pause before attempting European innovations, which, however consonant to our own ideas, may be at wide variance with the religious prejudices, and the associations, the feelings, and habits, consecrated by the working of a series of ages. It were certainly by far our best policy in the mean time to act cautiously; to gradually improve the defects of the native institutions, and to uphold what is praiseworthy among them; to repair what has mouldered into decay; and rather to re-construct than to destroy. The influence of example will act much more beneficially than law or edict. We perfectly agree with the following

opinions of an eloquent writer in the Edinburgh Review (July 1824):—

"As conquerors," it is there said, "we have to dread the explosion of fresh conspiracies against our newly acquired territory; and when we consider that there is not, in any part of India, above *one* European to *fifty thousand* natives, and that in many parts the proportion is much smaller, this disparity presents, it must be confessed, strong temptations to rebel; and it is only by the greatest moderation and justice that we can avoid this danger. In the capacity of legislators, the greatest danger arises from our ignorance and inexperience in the local usages of the country; in consequence of which, with the best intentions, we may commit the greatest errors, and agitate the country with the dread of perilous innovations on manners and customs interwoven with the very frame of Indian society."

There is some difficulty in estimating the price of agricultural labour in India, as the subject is somewhat complicated. The ploughman receives daily three seers of forty-eight sicca weight of coarse grain, such as barley or Indian corn, in value about two pice. He has also the use of his master's plough and oxen every fourth day, together with a portion of land for his own cultivation and use.

For his harvest labours he is entitled to a sixteenth of the produce. His family act as gleaners on their own account; and, notwithstanding the greatest vigilance, many stalks are left uncut, and many purposely thrown aside for their picking up. In case of marriages in his family, the labourer also claims, and obtains assistance from his master. He only works six hours a day, the cattle being out during that period alone; he is then his own master, and occupies himself as he thinks best. The blacksmith and village barber also come in for a certain share of the produce of every field. When these are all employed by the indigo planter, the ploughman has per day four pice; the carpenter, blacksmith, and bricklayer, two annas. The labourers of India are exceedingly moderate in their mode of living; and while with ourselves, and more especially with our English neighbours, it is estimated that nearly two-thirds of the earnings are spent on food, in Hindostan one-third alone suffices for that purpose.* They are submissive, obedient, and respectful to their

* "As an example," says Mr Gibbon, "bricklayers were sent for to a distance, and one rupee advance was made to each. On their arrival, they said that they had left the advance with their families, and now required another for their own expenses. This was not agreed to, but credit was given them

employers; and, when encouraged and kindly used, will work well and diligently. An opposite mode of treatment will not do with them; and severity of any kind will be resisted by idleness or apathy. Though slighter made than the European, it is thought that the Indian is fully equal in strength, allowing for difference in weight, the boat-men and the palanquin-bearers affording evidence of the fatigue which they are capable of enduring. A noise has, within these few months, been attempted to be made regarding slavery in Hindostan; but, probably, they who have talked loudest know least about it. Where it can be said to exist it is little more than in name, for it in nowise differs from that of the hired labourer, saving that the latter is completely bound to his master by the debts which he has incurred, and the former by the price paid for him. Indeed, it may be said, that the slave is treated with even more indulgence than the mere labourer, being oftener employed in domestic offices, and brought up as a member of the family. Were any degree of severity shewn to him, he would most certainly run away; and, that this rarely or never happens, is a convincing proof of the kindness with which he is treated.

To give an idea of local agricultural expenses, we may quote the following items from Mr Gibbon: *—

"In Tirhoot, the price paid for throwing up embankments on the Great Gunduck is at the rate of one rupee ten annas per 100 cubic sicunderee yards of excavation, which was also carried nine yards to the embankment. The Nonea caste is employed in this work, in which they are very expert. They use a very heavy hoe to dig the earth, and a strong wicker basket to carry it in. One man excavates or carries ten yards a day. The Secunderee yard is thirty-three inches in length. The same labour in England would cost L.2, 10s. per 100 yards."

We have already hinted, that most fallacious ideas exist in this country regarding the general wealth of India. A writer in the Friend of India, who appears to be quite versant with his subject, states his conviction, that the rent generally paid by the ryot in the rich province of Bengal, does not amount to forty

with a Bunea for their daily expenses, and two pice for each man was fixed as all that they required. These were Mahometans, who are considered more extravagant than the Hindoo in their living."

* Transactions of the Agricultural and Horticultural Society of India, vol. ii. p. 182. We take this opportunity of returning thanks to Mr Bell, the Secretary, for the attention manifested towards us in his presentation copy.

rupees per annum. After surveying minutely a district in the Carnatic, Sir Thomas Munro mentioned the same sum as the average payment, and gave his opinion, that there was not a cultivator in it worth five hundred pounds. This must naturally be the case, as the rent in India amounts to more than a third of the produce yielded by the farm. All that a tenant therefore can accomplish, is to keep over his head a house constructed of mud, straw, and leaves, to clothe himself in coarse cotton, and make a few handfuls of rice, " day by day his daily bread."

The mode of preparing fallow in India is simply this: In the months of April and May two ploughings are made. The perennial weeds, thistles, and thorns, are dug out with the hoe, and destroyed, by being exposed to the sun. After the rains set in, the ploughing and cross-ploughing is continued every fortnight, and in this way the seeds of annual plants spring up and are destroyed by the plough, which is particularly efficacious for this operation. The whole of the cattle belonging to the farmer or proprietor are kept on the field during the operation of the fallowing, that is, for four months, and this is all the manuring which the land obtains. The animal manure of the other eight months is wasted or burnt. When the sowing season arrives in the beginning of October, the field is clean, and in perfect tilth. We may again here remark, that one of the greatest errors in Indian agriculture will be found in the neglect of enriching the ground with manure. The bane of this system probably will be found in the custom of using the dung of animals as fuel. They have no idea of using straw as a component part of dung, and a great portion of it is also burned or wasted. Nor are crops sown particularly for the support of the cattle. No kind of grass has been yet selected for this purpose, although it is evident that such grasses exist naturally, mixed with others of a coarser kind. Europeans have attempted to introduce the culture of exotic grasses, but the trials have been imperfect, and not properly persevered in; nor have their results been promulgated in a way to make them practically instructive. For a short time the far-famed Guinea grass, found so useful in the West Indies, and which was for some time a favourite, has been abandoned, and its cultivation lost to the East. Sugar cane, the stalks of the great and small Indian corn, and the green hulm of Kissaaree or In-

dian vetch, are occasionally used by the natives as fodder; but this is never done systematically, and no crop is ever sown expressly for the food of cattle. The whole of their pasture is derived from lands which are reckoned not worth cultivating; and the fact seems entirely to be overlooked, that, if better food were provided, not only would straw be spared for litter, but fewer cattle required.

Having now succinctly alluded to the elements of Indian society, the price of labour, the domestic animals, and the implements of husbandry, we shall now proceed to a brief consideration of the system of tillage, and the mode of cultivating particular crops.

In the bringing in of new lands, the method adopted is the following:—The wastes are almost in a state of forest, being covered with prickly bushes, perhaps of twenty or thirty years' growth, the interstices being filled by the creeping grass called Huryalee or Nut. The roots of this grass form a mat, which reaches perhaps eight or ten inches from the surface, choking all other herbaceous growth, and the better the land is the thicker this carpeting. It is nearly as difficult to reclaim lands in this state, as to commence settlements in the American wilds. The chief instrument employed is the heavy plough already described to work which a team of ten good bullocks is necessary. Notwithstanding their great strength, buffaloes are unfit for this work, the climate being too hot for them, and the supply of water, which they cannot do without, being somewhat precarious. The quantity of new land which such a team is supposed capable of breaking up during a season is about three-quarters of Mar, or about twenty-four of our statute acres. The cost of cutting down the bushes and grubbing up the roots is estimated at 60 rupees; the keep of the bullocks for the seven months required of hard labour, 150 rupees; 120 are charged as the wages of four labourers; and 40 rupees for the tear and wear of implements, thus making up an outlay of 700 rupees before any return is made to the cultivator.*

The ploughing commences immediately after the rains, the ground being then soft enough to allow the plough to penetrate

* Marshall's Statistics of Bagulkot, p. 115.

to the necessary depth,—that is, completely below the matted mass of the roots of the huryalee, or natural grass.* It requires the whole strength of the team and drivers to force the instrument along, as the plough is constantly apt to be started from its course, leaving the rooty mass unbroken. Work commences in the morning after breakfast, generally about eight o'clock, and continues uninterrupted until about sunset, when the animals are loosed from the yokes, permitted to graze for half-an-hour, and then driven home. This operation is daily persevered in for seven months, in which time it is estimated that the twenty acres brought in shall have had three complete ploughings, one direct, one transverse, and one diagonal. The land still remains exceedingly rough, but the destruction of the grass roots shall have been pretty effectually accomplished, and after a little softening by the rains, together with two or three harrowings, they are easily removed.

During the first year either cotton or hurburee (*Cicer Arietinum*) is sown. If the first, this takes place in September; if the second, which is much more usual, in October. The crop, however, of either is always a poor one, sometimes scarcely worth gathering, but is found useful in bringing the surface to that consistency and firmness which the cultivators find it necessary to maintain in the alluvial soil. The great plough is forthwith discarded, and the more valuable of the draught bullocks sold, as unnecessary in everyday agriculture. In the second and third years a good deal of hand-hoeing is required wherever the pertinacious huryalee makes its appearance, thus incurring during these seasons a probable expense of sixty rupees more, making a total for bringing in of seven hundred and sixty in outlay. Nothing more is required but a levelling with harrows, or a block of wood drawn by a pair of bullocks, the driver sitting on it to increase its weight. By these means the clods are broken, and the rains solidify the soil, so that by the termination of the third season, the land is supposed to be in that state kirdee or high tilth. During the two years spoken of, the

* The *Agrostis linearis*, a grass on the beauties of which, says Mr Marshall, Sir William Jones is quite enthusiastic; but it did not quite so well suit his poetical purpose to characterise it as one of the most pestilent nuisances of husbandry. Report on Bagulkot and Badamy, p. 114.

crops are the same as the first, but considerably better in quantity and quality.

Lands thus made are never afterwards ploughed, unless we choose to designate by that name the scratchings of the instrument which makes the drills for the seed; the whole preparation being summed up in the clearing the surface with the scalping knife or kaloo, which we have before mentioned.* No manure whatever is ever applied to them, nor do they ever receive any intermission of their annual cropping, except when cotton is the subject of culture, in which case it is not deemed good husbandry to have it for two successive seasons on the same ground. But as to wheat, hurburee, and above all white joaree, the same crop may be repeated annually for a century, without even the smallest apparent deterioration of produce. How the late Sir Humphrey Davy would have accounted for this phenomenon, we know not, it being a favourite maxim with agricultural philosophers, that if something be not continually brought on the land equivalent to what is taken off, gradual ruin must be the consequence; and that great man carried this speculation so far as to ascribe the present sterility of Sicily to the quantity of grain taken away from it by the Romans.

* "When the enterprise of breaking up this land," says Mr Marshall, "is undertaken by people of inadequate capital, who can neither bring to it a team of sufficient power, afford to feed the bullocks in the extra manner which the severity of the labour requires, or advance the wages for able labourers, it may be said altogether to fail. The rooting grass is not half eradicated, and year after year gains more strength and a wider field. Though the same system of cropping goes on as if the land had attained its full powers, yet there is a melancholy inferiority in its produce, and there cannot be a more remarkable contrast than that which was exhibited in the present season (1821) on the rich lands in the southern parts of the district, between the field of a ryot of capital, and that of his poorer neighbour thus circumstanced. In the former the crops were close, even, and vigorous; in the latter scattered and stunted, even where the plants had come up at all; but in at least half the space they had not been able to break through the straggling grass of the huryalee. Land in this condition is considered as a sort of demiwaste, and if its improvement be undertaken by a capitalist, sixty hoons (240 rupees) per mar (24 statute acres) are required to be expended the first year in hoeing up the roots of the pernicious huryalee, and thirty in the second,—an expense scarcely inferior, the team excluded, to that which when rightly applied was sufficient for the recovery of the oldest wastes." Statistical Reports, p. 116.

The subjects of culture which we have just mentioned, are all of the latter harvest or rubee, and are sown either in September before the final rains of the south-west monsoon, or in October immediately after them. A prior crop of some one of the articles of more rapid growth has been sometimes attempted by farmers, but the more experienced and sensible deprecate the practice.

Where the black soil is prevalent throughout the country, the most elevated situations, where the substratum comes nearest to the surface, have been selected for the sites of villages, not only as being cleaner, but as affording greater facilities in digging for water. This elevation is the reason why around these villages, in a small circle, we generally find the black soil disappearing, or shallow, and largely intermixed with the matter of the substratum, which materially alters its properties, and puts it into that rank of land called musab, to contradistinguish it from the lands whose mode of culture we have just described, and which have been termed regur. The mode of cultivation practised on the musab soil, we shall now briefly notice.

The tillage of the Musab lands is quite different from that pursued in the more fertile soil, and though their composition be various, it is nearly alike in them all. Not being overrun with the vexatious huryalee or nut grass, the great plough is not used on them, indeed it could not well be, as the soil is often shallower than would be its working. As the surface of these soils, more especially the more sandy ones, is very apt to cake and harden after rains, the end proposed in tillage is to keep them as loose and friable as possible. Their fertility, unlike that of the black soil, seems to depend almost entirely on the manuring bestowed on them, and may therefore, as Mr Marshall remarks, be considered as the mere bed of the vegetable, while the manure is its food. Indeed, this necessity of manuring seems to be one chief reason why the Musab lands are generally divided into small townships of from three to five or six hundred acres, as no part of that surface can be far distant from the village site, and the manuring operations thus greatly facilitated.

The manuring of these lands commences in March and is

done to the full extent that the farmer can afford; the manure being carried out on bullocks. When in April the casual showers commence, the land is thrice ploughed at intervals with the small plough, and the manure thus well dispersed through the soil. In May, the kaloo or cutting-knife is used, not, however, as in the black soils, but by passing it two or three inches below the surface, and thus destroying all the roots of the previous year's stubble, together with the weeds, which are then raked together and collected into heaps. In June, if the south-west monsoon rains have commenced so early, if not in July, the sowing takes place, and the drill plough already described is invariably used. During the first four or five weeks the bullock-hoe is twice used, after which, from the growth of the plants, hand-weeding becomes necessary, and this is generally performed twice in the course of the second and third months.

Whenever the heads of corn begin to appear, guards are placed over the fields, some on foot, others on wooden benches, others on trees, for the purpose of scaring away the large flocks of birds, which they do by slinging stones, and making all kinds of noises.

"The very best of the Musab lands," says Mr Marshall, "are excessively dependent on the favourable distribution of the wet during the rainy season paradoxical as it may appear, the more sandy the land is, the more is heavy rain injurious to its productiveness. After two or three days of continued rain, the sandy soil forms itself into hard balls, which quit the roots of the plants, and inclosing the fertilizing manure as in a shell, prevent its yielding up to them its nutritive powers. The farmers say that two or three showery days in a fortnight, are quite enough for them until the latter end of the season, when the grain is filling in the head, and then a good deal of rain is very assistant to that natural process."

We come at length to direct attention to the cultivation of particular plants and grains, and must commence with the agriculture of the coery caste, as most deserving of notice.

A portion of the finest Musab lands, commonly designated dhee, and elevated above the surrounding country by the wreck of mud houses, ashes, fragments of pottery, and decayed vegetable and animal matter, is chosen for this species of agriculture, which nearly resembles gardening.

After the fallow or first crop, during the rains, these lands are prepared and laid out into small hollow beds, from six to nine feet square, wherein the grain crops are sown and watered, but

more particularly the poppy (*Papaver somniferum*). The water is supplied from wells of solid masonry, and seldom less than twenty-five feet deep, the water being raised in a leathern bucket, by the aid of a pair of bullocks, one man being required to fill and empty it, as well as guide the team, and another to conduct the water over the field. After the first watering is accomplished, half a beegah a-day* may be thus irrigated, and the productiveness is very much increased by this operation. The superstition of the natives leads them to suppose that some peculiar fertilizing properties reside in the water of different wells.

We have said that the very best soil is required for the successful cultivation of the poppy, and great care and attention are requisite during its growth.

After the thorough manuring and pulverization of the ground, which we have briefly described, the ground is then divided into little squares, four or five feet each, surrounded by a slight embankment of earth ; and the seed is sown broadcast in December. From three to four pounds avoirdupois are required for a beegah, or somewhat less than one-third of an acre. A week or ten days after sowing, irrigation is necessary, and the ground is flooded to the depth of two or three inches; and this is repeated not less than seven different times, at the intervals of ten or twelve days. While the surface is still soft, after each watering it is carefully stirred by a small iron instrument, and the weeds destroyed. The plants are afterwards thinned, five or six inches being left between each.† The flowers show themselves in February, and by March or April the capsules are in a fit state for the extraction of opium. This is shewn by the capsule assuming a whitish colour, generally a week after the petals fall off; and incisions are then made into it with a three-toothed iron instrument, each tooth being half a

* "The size of the beegah over the greatest part of North Behar, is 4000 square yards, increasing towards the north frontier to 6000 yards. In South Behar it is 3200, or exactly two-thirds of an English acre." Transactions of Agricultural Society of India, vol. ii. p. 191.

† "While the plants are very young, those which are thus removed," says Mr Porter, "are used as potherbs, but when they have attained to the height of about a foot and a half they have an intoxicating quality, which renders them unfit for this purpose." Tropical Agriculturist, p. 374.

line distant from the other. From these scratches a white juice exudes, which becomes concrete, and is collected in a small iron scoop at daybreak. The first incisions produce the best and most abundant juice, but the operation is repeated daily, in the afternoon or evening for a fortnight. The opium thus collected is kneaded with water, till it becomes of a pitchy consistence.

The production of opium in Bengal is an exclusive monopoly of the government, and a large revenue is thence derived. The raw juice being thus procured, the agents of the Company superintend its preparation, which consists in the evaporating of the aqueous particles by exposure to the heat of the sun. It is then kneaded into cakes, admixing a little of the oil obtained from the poppy seeds to prevent over-hardening, and packed into chests, wrapped up in the chaff of the same; fifteen per cent. is allowed over the quantity packed, it being estimated that a loss to that extent takes place on the opium being kept. The mode of procuring and preparing the opium in the Mahratta districts is inferior to that adopted by the Company, and the article is much inferior, probably from the quantity of oil used both during the collecting, and during the preparation.

The produce from poppy grounds varies, of course, from season and other casualties; but, according to Mr Tennant (*Vide* Indian Recreations), it has been estimated by some cultivators so high as sixty pounds opium per acre; by others, as low as thirty. Mr Porter thinks, however, that the latter is nearer the truth. The white poppy yields more than the red; the medicinal quality of both is supposed to be the same. The *papaver somniferum* is the species from which opium is obtained.

A large revenue is obtained by the Company by the monopoly of opium, but it is said that this is not the only motive by which the Board of Directors are swayed. The drug is for one thing easily adulterated; and for another, it is necessary to control the traffic in an article, whose use might prove so demoralizing to the people. "Were it possible," say the Directors of the East India Company, "to prevent the use of the drug altogether, except strictly for the purpose of medicine, we

would gladly do it, in compassion to mankind; but this being absolutely impracticable, we can only endeavour to regulate and palliate an evil which cannot be radicated." *

Laws have been enacted by that singular people the Chinese, forbidding its use; † yet in spite of them, that country forms the great market for the opium of India; and little or none produced there finds its way to this country. The opium of Turkey being considered the best any where produced, the pharmacopolists of Great Britain derive their supply from thence.

The revenue obtained by the Company from the sales of their opium has of late years greatly increased. In 1810 it was only L.580,000; in 1830 it amounted to L.2,000,000. In 1817 only 2435 chests were imported into China, while in 1830 there were 16,305.‡

Next to the poppy, the sugar-cane lands are cultivated with the greatest care. Indeed, it would not be easy to suggest any hints for improvement, either with regard to the mode of preparing the land for this product, or in their subsequent management. Throughout India, however, the same degenerated species of cane continues to be used, nor can the cultivators help themselves, until supplied with a better. It is everywhere considerably inferior in strength to that of the West Indies, and that produced even in the fertile province of Guzerat, can only be converted into coarse molasses. The cultivation of the cane in the East has also been, in a great measure, cramped by the additional duty which it has been thought necessary to levy in Britain upon it, in consideration of the depressed state of the sugar lands in the West. It has therefore been made entirely, or very nearly so, for internal consumption, although it is maintained by many adequate judges, that the introduction of British industry, machinery, and capital, would in a short time produce a supply adequate to the consumption of the whole empire.

When the canes spring up, they are carefully hoed and watered during the drought of March, April, and May, three months dry weather after planting being extremely unfavourable,

* Report of the House of Commons on East India Affairs, 4th Appendix.

† Asiatic Register, vol. iii.

‡ Porter's Tropical Agriculturist, p. 370.

irrigation being only able to supply the roots, and not the leaves, with moisture. Notwithstanding this disadvantage, however, it is well known that canes can be produced an inch and a half in diameter, and from eight to ten feet high, without the head. The great error in the East Indian manufacture of sugar, lies in their not clarifying and draining it by the first process, instead of which the juice of the cane is concentrated with all its impurities, and made over to the hulwaye or confectioner, who commences his process of refining after the heterogeneous mass has become too cold to drain well, and an incipient fermentation has commenced in the mixture of impurities, molasses, and crystallized sugar. A second boiling is thus rendered necessary, a process always unfavourable to crystallization.

It is said that the sugar-cane found its way from the east by the Mediterranean, to the Islands of Madeira and Canary, and thence to the West Indies. But the cane now cultivated in the West Indies, according to the authority of Mr Porter in his History of the Sugar Cane, was derived from Otaheite. We have already stated our belief that the British Empire could be readily supplied with sugar from our eastern possessions, and this is strengthened by the opinion of Sir John Malcolm, who mentions that this important article of commerce could "be manufactured to any amount in India, and, from the low wages of labour, at a rate that would eventually enable it to compete with this produce from other countries, in the home market." Mr Graham, also, in his excellent essay on "the Means of Ameliorating India,"* remarks, "that were there any demand for this article beyond their own domestic consumption, no one can calculate the extent to which the Hindoos could supply sugar, at the cheapest rate, to all the European states, through the medium of the steam communication now about to be established by the Red and Mediterranean seas." To these we must add the authority of Mr M'Culloch, who, in his Dictionary of Commerce, gives it as his opinion, "that great however as the increase in the use of sugar has certainly been, it may be easily shewn that the demand for it is still very far below its natural limit; and that, were the existing duties on this article reduced, and the trade placed on a proper footing, its consumption, and the revenue produced from

* Pages 67-8.

it, would be greatly increased." The propriety of equalising the duty on East and West Indian sugars, we must now, therefore, leave to the consideration of our legislators.

The cultivation of the cane was practised in the East from the most remote antiquity; and we are informed by Vitriace, that sugar was obtained in Syria during his time, which was the commencement of the twelfth century, by squeezing the reeds by means of a screw-engine, the juice being afterwards concreted by fire. On its first introduction into Europe, sugar was used only medicinally; but it gradually became an article of almost unlimited consumption, and now stands high in the rank of our most important commercial resources,—the annual consumption in Europe being estimated at 450 millions of pounds. The export from Hindostan gives but a fractional proportion of this, amounting to only 5,590,760 lbs., being somewhat less than one-eighth of the whole. "Yet," says Mr Bell, "the West India proprietors dread our power of competition! Admitting them to have a well-grounded fear, would it not be wise and politic to bring down the scale of duties on East India sugars, so as to tempt the application of capital and skill to the improvements of an article whose inferiority is alone consequent on the want of these? In the event of any sudden emergency, how could England expect India to meet in quality or quantity the requisite demand? In times of profound peace it may be well enough; but should political convulsions ever have the misfortune to recur, by which our Western Colonies may fall into the hands of a foreign power, the value of East India sugars would then, if they do not before, claim the serious and most liberal consideration on the part of the legislature, to give due encouragement to the present limited extent of sugar exports from this country (India), which has the natural effect of attracting attention to increased cultivation in other parts of the globe."*

There can be no doubt, it seems admitted on all hands, that greater attention paid to the preparation of the soil for the plant, a better selection of cane, and the introduction of European skill and superintendence in the preparation of the product, would

* *Vide* Review of the External Commerce of Bengal from 1824 to 1830, with Appendix of Tables, &c. By John Bell, Esq. 4to. Calcutta. p. 28. [illegible] of g[illegible]tility and research.

tend immediately and immensely to raise the character of East Indian sugar as an article of commerce. Mr Holt Mackenzie and Mr Gisborne bore strong evidence to this fact in their examination before the Revenue and Sub-Committee on the Affairs of India; and Dr Wallich, whose authority on these subjects is of first-rate importance, on being questioned by the same, "What were the products of India most likely to be of commercial importance?" gave for answer, "Sugar, cotton, coffee, silk, indigo, and tobacco." Do you name them in the order of their importance, was then submitted to him? to which his reply was, "I place sugar before indigo, because indigo is limited in consumption, sugar perfectly unlimited." *

On the authority of our friend Mr John Bell, of the Custom-House, Calcutta, and author of several most valuable works on the Commerce and Agriculture of India, we may state, that the total quantity of sugar exports from India to all parts of the world between 1833 and 1834, exceeded that of the previous year by 61;015 bazar maunds. Mr Bell concludes his report on this article by saying, "We stand in need of no other assistance than the impartial equalization of duties. Capital and skill will do the rest." It is estimated that the produce of a *beegah* of cane, even according to the native and most imperfect mode of cultivation, will give from eighteen to twenty maunds of goor, from which about five maunds only of sugar will be obtained, the rest being molasses. Hence the necessity of a rum distillery on the European principle being attached to every sugar mill, else the molasses, together with the sugar scummings, would be little better than lost, the price obtainable for them being scarcely more than nominal. A distillery would consume the whole refuse, and a rum, equal to that of Jamaica, be obtained in abundance.

From the cane we now pass to the cotton tree, many species of which are indigenous to the soil of India. Mr Sullivan, late collector at Coimbatore, says, that two kinds are native to that part of the country; and Mr Gibbon, in his essay on the agriculture of Behar, specifies three varieties as cultivated there, Rehdhea, Hawlee, and Jeitowa. The Rehdhea is the finest, and

* *Vide* Comparative View of the External Commerce of Bengal, during the Years 1832-3 and 1833-4. 8vo. Calcutta: 1834.

is sown about the autumnal equinox, along with oil seeds. These ripen in January, when the stalks are pulled up by the roots, and the ground thoroughly hoed and watered. This operation is continued through the months of February, March, April, and May, when the cotton ripens. It is said that the fine Dacca muslin was formerly made from this cotton, but now there is none exported from the district where it grows.

The Hawlee cotton is sown along with the Indian corn in June. The corn is cut in September, when the lands are hoed and watered only two or three times until May, when the pods are gathered. The produce and quality of this variety is nearly equal to that of the Rehdhea, the quantity of seed to cotton being as three to one. In like manner, the Jeitowa cotton is sown along with Indian corn at the beginning of the rains. While growing it requires neither cultivation nor watering, and the proportion of seed to cotton is as five to one. This is the kind of cotton so well known in commerce. Another kind called Kokety is cultivated in the north of Tirhoot; it is of a yellow colour, and is preferred for making fine thread. The produce is generally scanty and impoverished. We believe that there is great truth in the supposition, that the degeneracy of the Indian cotton may be in a great measure imputed to the careless and slovenly manner in which the natives pick it from the pods on the tree, taking a portion of the dry brittle husk along with it, and allowing it to acquire dirt and sand by carelessly tossing it about on the ground when separating the seed. In America this is obviated by the trees being planted in rows at considerable distances, so that, in gathering it, none of the dried leaves are brushed off among the fine fibres of the cotton.

By adopting this mode, and by using machines for cleaning the cotton from the seed, there can be little doubt that the staple and fineness of the Indian cotton might be so much improved as again to fit it for the English market, and compete with the American. "Thousands and thousands of acres," says Mr Graham, "black as ink, and of inexhaustible fertility, lie a perpetual waste on the plains, betwixt any two villages in the Deccan, all capable of producing cotton and other products available to the wants of man. Labour is also so remarkably cheap that in Guzerat a man is hired, not including his food, for the small

sum of L. 3 per annum. In the Deccan, according to the reports of Lieutenant-Colonel Sykes, the average is about L.3, 12s."*

As constituting the material of the principal manufacture of India, cotton ranks next in importance to rice, its staple grain. We have already hinted that the quality of that at present raised by no means equals that either of Brazil or of North America; yet it is reasonable to suppose, in a country where the cotton tree in such varieties grows spontaneously, and in such luxuriance, that a due attention paid to its cultivation would soon render the product superior to that of countries not so congenial to it. In reference to this article, the late Sir John Malcolm, that enthusiastic benefactor of India, informs us, that, "deeming this a subject of much national importance, I not only gave it my attention in India, but have continued to do so in England. I visited Manchester, and have communicated with all from whom I could obtain information calculated to promote the object. The result has been a conviction that a much greater proportion of the trade in this material than India now enjoys may, with care and management, be obtained to that country, a result which will prove equally beneficial to it and England." Speaking of the Bourbon cotton, Mr Sullivan also says, that "all that is wanting to evince the extended cultivation of this species of cotton, which is superior to most of the American uplands, is the judicious application of a large capital. A steady encouragement of the staple would be one of the greatest benefits that England could confer upon her Indian empire." It may be remembered by some that it was the produce of this plant which sold in the London market in 1830 at 8d. per pound, and which, if a sufficient quantity could have been obtained, would, in the opinion of brokers, have realized 9d. From the number of valuable papers on the subject in the last volume of the Agricultural Transactions of India †, it is

* Means of Ameliorating India, p. 66-7.

† We particularly allude to the papers on the cultivation of cotton by Baboo Radhakant Deb. On the culture of cotton in the Dooab and Bundelkund, by W. Vincent, Esq. On the artificial production of new varieties of cotton, by H. Piddington, Esq. Method of preserving the cotton plant in Cayenne. Remarks on the cotton of Ava, by Major Burney. On the cotton of Cachar, by Captain Fisher. On the cotton of Dacca, by Dr G. Lamb. On the culture of Upland Georgia cotton at Allahabad, by Mr Higgins, &c. &c.

evident that an ardent desire to improve this very valuable plant now pervades India; both the soil and climate of which seem so admirably calculated to bring it to a perfection it has by no means hitherto attained there. Indeed we have little doubt that, with proper care and cultivation, the cotton of India may be made to compete with the American, and rendered fit for the English market,—a circumstance which would be extremely beneficial for both countries, as we might receive all our raw material from the east, and, through the aid of our admirable machinery, return it to them again in the shape of cloths of our varied manufacture.

"It is poverty alone," as Mr Graham admirably remarks, "that prevents the Hindoos from taking a greater quantity of British merchandise. The country is nearly exhausted of its wealth, and there is little or nothing at this moment raised within it to counterpoise that exhaustion. The consequences are obvious. India is becoming every day less and less able to afford the revenues she formerly yielded. She is falling behind in the race of competition. Other nations are taking out of her hands various important branches of trade. America is fast making head against her through the fostering care of genius and enterprise. Long before that country was known to the civilized world, India supplied Europe with cotton and other useful articles, but now almost all her productions are superseded by that rising people. It may be demanded, however, Is India drained? No, by no means. She still possesses a revivifying power. Her resources are great. Richer treasures than those she yielded to Solomon still lie buried in her bosom. England has long had this eastern gem within her grasp, but she has not yet learned how to appreciate it, nor does she yet know half its value. Let the children of England cultivate the resources of India,—let men of capital and skill give her the benefit of their talents, and they will find that her capabilities exceed their most sanguine expectations."

We should now proceed to the cultivation of rice, the grand staple food of the east,—of the coffee plant,—indigo,—tea,—mulberry,—the farinaceous roots, and other subjects of Indian agriculture. This article has, however, reached the limits which we had assigned to it, and we must leave the consideration of these and other topics of peculiar interest for our next number.

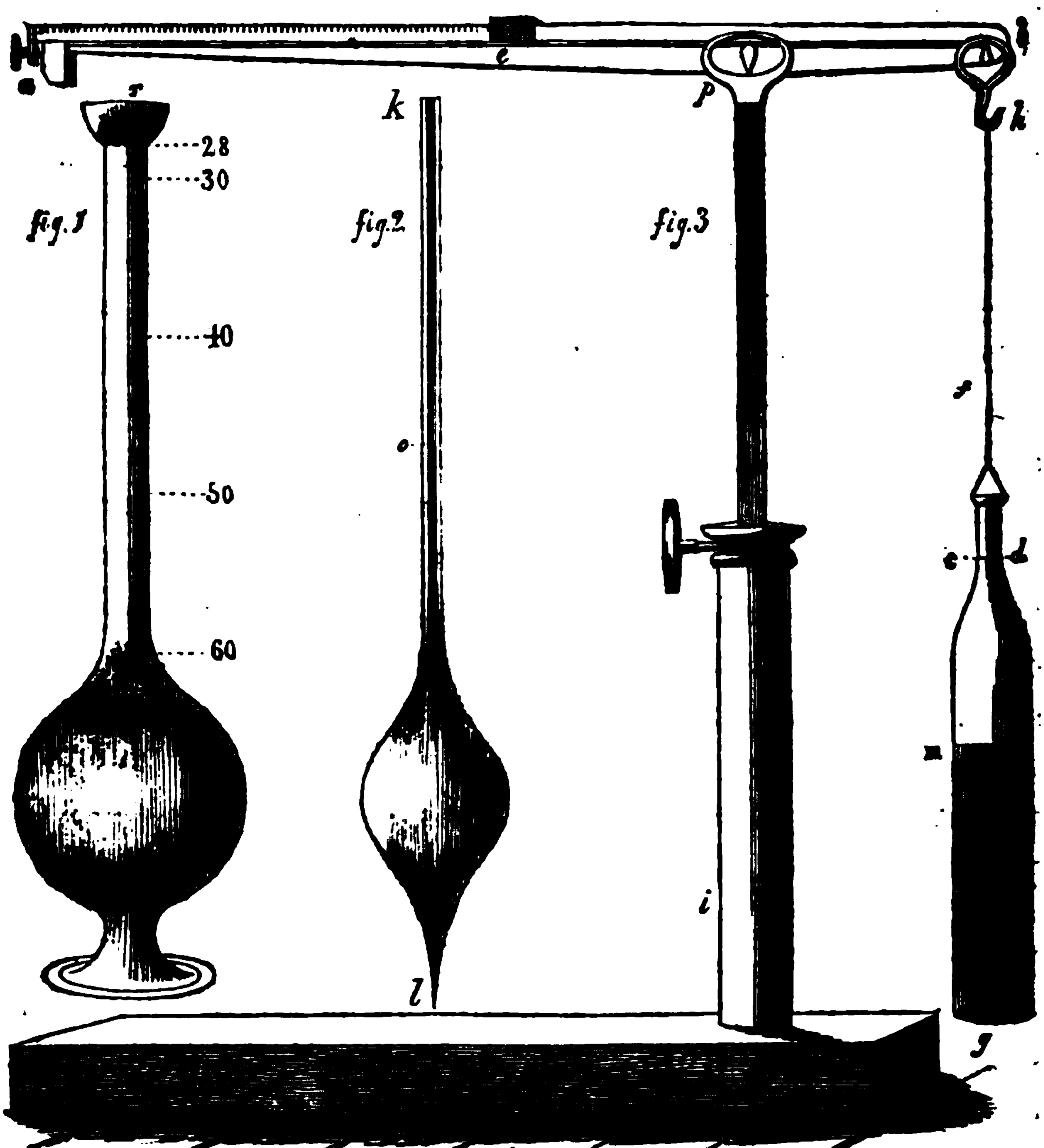
THE HORDEOMETER.—AN INSTRUMENT FOR DETERMINING THE WEIGHTS OF A GIVEN MEASURE OF ANY SORT OF GRAIN WHICH MAY BE HEAVIER THAN WATER.

By Mr George Buist, London.

The extreme importance of determining the weight of barley to be used for the purposes of brewing or distillation is notorious to every dealer in grain. Barley is valuable exactly in proportion to its specific gravity, or its weight per bushel, and certain allowances in prices are, accordingly, in general made in proportion as it falls under or exceeds a specified standard. The mode of determining the weight of given measures of grain in the stock market, is to have a bushel, or fraction of a bushel, carefully weighed and measured on the spot. This process is slow and inconvenient amidst the bustle of a crowded market-place, and what is worse, it is uncertain and incorrect in its results. Although the weight of grain may be determined with considerable accuracy, to within the 800th part of a bushel, with a common beam and the most ordinary attention; the measuring process is inevitably uncertain with any management, and may vary under different hands to the extent of 1 or 2 per cent on the bushel. This is irremediable when grain is poured into a dry measure, however exact that measure may be in its dimensions. It is notorious, that according as barley is poured into the measure in a deliberate stream, or by a sudden plump, the weight will vary from 1 to 2 lb. in the bushel, and will in a proportional degree affect the real value or equitable price. If such be the case in stock markets, how much greater must the inconvenience be where samples alone are exposed. Yet the great transactions at Mark Lane, and in most proportion of the markets throughout the kingdom, are entirely performed in samples. When a sample is exhibited and the weight stated as having been determined at home, you have the triple difficulty in regard to its correctness; first the essential uncertainty from the fallacy inherent in the principles of measurement; second, of accidental inadvertence in the measuring or weighing process; third, of interested inaccuracy on the part of the weigher, measurer, and seller. It is besides notorious, that it is only of

the finer qualities of grain that the farmer is in general disposed to certify the weights, and that of the lighter kinds, of all in fact beneath the average of the market, the corn-merchant has no means whatever of judging, but those uncertain ones of feel, colour, and general aspect; vague tests in all cases, and applicable in proportion to the observation and skill or experience of the dealer who is compelled to resort to them.

To obtain a full and perfect remedy for the loss and inconveniences arising from these is the object of the present contrivance, which may be called the *Hordeometer* or barley-



measurer. It is hoped that it will be manifest from the subjoined explanations, that the principle upon which the instrument is constructed may be easily and unerringly applied. That the instrument itself will be found simple, cheap, and readily applicable; that it will test an ounce weight of barley to within

$\frac{1}{100}$ part of its weight, that is, that it will be ten times more correct and delicate in its indications than is the present weighing process, even where a whole bushel of grain is manipulated; so that by its means the error committed in measuring and weighing on the large scale may be corrected. It may be made of such a size as to be packed up in a box and put in the pocket to be carried to market for use.

In the following description, both the numbers referred to and the dimensions adopted are purely arbitrary, and may, without affecting the question, be exchanged for any others which experience may prove to be more convenient.

The measuring portion of the instrument consists of a long-necked glass phial *f g*, fig. 3, such as those used for *eau de cologne*, capable of containing from three to four ounces of water. This is accompanied by a thick glass-tube or meter *k l*, fig. 2, blown into a bulb, and having its lower extremity *l* drawn into a fine capillary point. This must not contain more than $\frac{1}{3}$ the fill of the phial. The first thing to be done is to compare the capacity of *k l* with that of *f g*. Apply the lips at *k*, and suck up as much water as may rise to some point *o*, so that a given number (say three) of fills up to *o*, may rise in the phial to some other point *c d* in the narrow of the neck. This having been very carefully attended to in many repeated trials, diamond marks are to be made round both vessels at *o* and *c d*. A mark may be also made at *m*, one precise measure of *k l* below *c d*.

For the weighing part of the apparatus, apothecaries' scales, a spring balance, a steel-yard, or any other contrivance, will equally answer, provided it will indicate half a grain troy or thereabouts The following seems a very convenient form. Let *a b* be a steel-yard or beam of unequal arms, of which the one extremity *a* is 10 and the other *b* 2 inches from the fulcrum *p*. Let it be fitted up on a sliding stand *p i*, which again is fixed into the side of a small mahogany box, into which the whole instrument may be packed when not in use. A weight is appended at *a*, which, together with the longer arm of the steel-yard, must exactly counterpoise *f g* when filled with pure water up to *m*. The hook *h* is meant for the suspension of *f g*. The weight *e* when placed equidistant from the fulcrum *p* with *h*, should counterpoise one measure of *k l* up to the mark *o*, and so should

sustain the whole in aquilibrio when the phial is full of water to *c d*. The finger screw at *a* is meant to adjust the sliding counter-weight *e* to make up for impurity or hardness in the water. The steel-yard from *a* to *e* should be carefully divided into, say eighths of an inch, that is, into 64 equal parts, this limb being 8 inches long from *e*. The Hordeometer now wants nothing but the figures to indicate the weights to be complete and fit at once for use. To obtain a standard for this purpose, reference must be made in the case of our first instrument to actual experiment; all subsequent ones may be taken from this as a model.

Select then a large parcel of good uniform barley, and have it as well mixed as possible; take a very accurate measure, and with the utmost care and by the most approved methods, measure out a bushel and have it exactly weighed and the weight noted. Repeat these measurings and weighings five or six times at least, and take the mean of the trials as the assumed weight of the barley, say 50 lb.; select a small sample of this, of as nearly an average quality as possible, and having put two measures of pure water into the phial so as to rise to *m*, pour in the barley till the water ascends towards the neck, and then drop it in grain by grain till it exactly coincides with the line *c d*. The phial having been carefully counterpoised before the barley was put in, it will require additional weights on the arm *a e* to restore the equilibrium.

The instrument just being described, is meant to weigh grain from 28 lb. to 60 lb. per bushel, and to indicate as low as half pounds.

Suppose the barley under consideration to have been ascertained to be exactly 50 lb per bushel.

Begin at *a* and count off 20 graduations on the scale towards *e*, and mark the degree stopped at. Place a weight here so as exactly to balance the barley in the phial and restore the equipoise of the whole. It is manifest that when barley of unknown quality is on any future occasion by a similar process put into the phial, which may be counterpoised by the weight now obtained being put on this precise point of the arm of the steel-yard, that that barley *must* just be 50 lb to the bushel, neither more nor less. We have thus got our first point, which may ac-

cordingly be marked 50 lb. We may now engrave our figures on the steel-yard of which every second one will denote a whole pound, the intermediate graduations giving the half pounds; of course, by the use of lesser weights which may be multiples of the primary or large one, the indications may be brought down to ounces or half ounces, if the beam will turn with those.

If this process seem circuitous, it must be kept in mind that it is only resorted to in *constructing* the Hordeometer. The instrument once made, all that is requisite in using it, is first to put its various parts together, then to pour two fills of water from *k l* into *f g*, next to fill in the barley to be examined till the water rises to *c d*, and last to slide backwards and forwards the weight till the whole is balanced, when the figures on the limb of the steel-yard will indicate at once the weight of the barley. The barley and water being now poured out and the phial dried, a second experiment may be entered on immediately. To save time, as the phials are cheap, it would be well to have two or three always ready, that the one might drip itself dry while another is being used.

Though barley is the grain which has all along been alone referred to, wheat, oats, beans, pease, or rye, may be equally examined by the Hordeometer, provided only their particles be heavy enough to sink in water. It may also be equally used for determining the gravity of spirits, wine, ale, or other solutions of whatever density or tenuity.

After the above details, it seems superfluous to say anything of the theory of the Hordeometer's operations. The whole consists in substituting a measure of water for an equivalent measure of barley. The object of doing so is, that we thereby are enabled to examine a fluid which is uniform and equable in its density, is very tractable and easily measured, instead of a congeries of irregular grains which individually vary in their consistence, and of which we can never depend on twice having the same number in a given measure. As we cannot take fractions, 400 or 500 grains of barley should always be employed *at least*, if we wish to come within half or quarter pounds in the weight. This suits very well with another condition of the instrument, the amount of water displaced by a single grain being as small a

quantity as can be distinctly observed in a phial of convenient width of neck.

We here employ the principle of a constant and uniform measure and a variable weight. Should the application of the converse of this be found more convenient in practice, it is equally accurate in theory. In this case we might have a balance with a constant weight attached, so that it would always be poised by one ounce of barley. This quantity we should pour into the long stemmed vessel *r*, fig. 1, so constructed that its neck being about ¼ inch wide and 8 inches long, should hold as much water as its bulb; a funnel-shaped mouth being formed at *r* for the conveniency of pouring in the grain. In this case the pounds weight would be indicated by the rise of the water in the graduated stem.

We restrict in fact to no particular form, but contend that nothing can be productive of better results than the principles of measuring here recommended.

Should scales be used instead of a steel-yard, which may indeed be more accurate for the first experiments;—having found the weight corresponding to barley of 50 lb., all that is requisite is to divide this into 50th parts for single pounds, and 800th parts for ounces, a process very easily effected by the use of common troy weights and the most ordinary druggist's balance. The precautions to be used to obtain a perfect average in a fundamental or model Hordeometer will occur to any instrument maker.

PATENT RECTIFYING STILL.

The construction of this distilling and rectifying apparatus, is exhibited in section in the accompanying plate, and consists of an ordinary still, between the head of which and the worm-tub is arranged a series of two, three, or more vessels, A A′ A″, which, from their office, may be termed *rectifying vessels*, through which the mixed aqueous and alcoholic vapours successively pass in their course from the still to the worm. The vapours issue from the still through the tube *a*, which opens at the bottom of the first rectifying vessel A, where they are condensed; they

again rise, and, coming in contact with the metal tops, or domes B, a considerable portion of *aqueous* vapour is condensed; while the remainder, with the alcoholic vapour, pass off from the centre of the dome through the tube *a'*, which discharges them in the bottom of the second rectifying vessel A', at the top of which an *additional* portion of the *aqueous* vapour is condensed, and the remainder with the alcoholic vapour pass off in a similar manner by the tube *a''*, which discharges them in the bottom of the third rectifying vessel A'', at the top of which a similar process of condensation of the *aqueous* vapour takes place, and the alcoholic vapour, with the very small remnant of aqueous vapour, pass from the top of the dome to the worm in the worm-tank, and are condensed in the usual manner. By this process of a *separate* condensation of the *aqueous* and *alcoholic* vapours, a very strong and pure spirit is obtained at one operation. The sides and bottoms of the rectifying vessels A A' A'', *are constructed of wood, which is an imperfect conductor of heat,* and the top of each vessel is closed by a dome-shaped covering of sheet copper, B B B, which is a rapid conductor of heat; and it is this combination of slow and quick conductors of heat in the construction of his rectifying vessels, for which Mr Shand claimed his patent. Owing to the slow permeability of wood by heat, the temperature of the condensed water in the bottom of the rectifying vessels is preserved at such a point, that the greater part of the spirit passes through without losing its gaseous form; while any spirit which may have been condensed is reconverted into vapour. The wooden sides of the vessels extend somewhat higher than the copper domes, as is shewn at C C C, for the purpose of holding water or wash, by which the metallic heads, B B B, are preserved at a proper temperature for condensing the *aqueous* vapour; *b b' b''* are three air-cocks for the rectifiers. A gutter from the centre of the bottom of each rectifier conveys the liquid deposited during distillation, through the cocks *d d d* into the boiler; *e e e* are three cocks and pipes intended to regulate the proportion of aqueous matter in the bottom of the rectifiers, and allow any excess deposite to pass back into the boiler; *f f f* are three distinct cocks for reducing or removing the water from the domes B B B; *g g g* are three spouts for taking off from the upper part of the domes the surface water;

h is a vessel to contain water for the rectifiers, with pipes and cocks connected therewith, and a gauging rod therein.

The most suitable dimensions for the rectifying vessels to that of the still, are found to be, for a 600 gallon still, the vessels should have capacity, the first A, of 200 gallons; the second A′, of 130; and the third A″, of 100 gallons.

The common still is perhaps the most ancient piece of mechanism in use in this country; and in almost every instance is yet preferred to any other. This patent apparatus, however, is simple and unexpensive, is more easily managed than the common still, and economises fuel and time. It yields a strong and better spirit, more in quantity, and with less feints than any other process. The products are free from acid, consequently less prejudicial to the stomach.

It must be evident to the most superficial observer, that when heat is by any means communicated to the lower part of any metallic vessel, and cold to the upper part of the same vessel, a very great proportion of the heat must be drawn up through the metal, and dissipated; but if the bottomand sides of the vessel be of wood, or of any nonconducting substance, little heat can pass through the wood, and nearly the whole of it must ascend through the interior; consequently it will act more powerfully on whatever may be contained in the vessel, and in so acting must be economised. For these reasons cold may be applied in a greater degree, and with more effect, at the proper point where condensation is necessary. The surface on which the cold acts being very limited, the temperature in the rectifier can be raised quickly, and more caloric allowed to pass to the succeeding vessel, and retain sufficient power to separate the alcohol when the proportion of the latter is very little to the water. It is also apparent that most beneficial effects are produced in the lower part of the rectifiers, the vapours being there condensed, and again raised from the surface of the boiling liquid as in a common still, but with a modified temperature. The alcoholic particles being apart from each other from the time they leave the boiler, are separately washed, and leave a portion of the aqueous matter by which they are surrounded in each bath. It is difficult to determine the various causes which lead to the preservation of so large a proportion of alcohol, but

one peculiar advantage is, that from their nature and construction, no extraneous matter adheres to the rectifiers, and that the tubes are easily cleaned.

The distilling apparatus which we have just described, was contrived several years ago, and patents for the same were obtained by Mr William Shand.

After a variety of experiments had been made in the London University, and elsewhere, with the best possible effect, an apparatus was constructed and sent to Jamaica, which was attached to a common still of about 1400 gallons, when it was found to purify the rum so much, that on reaching Britain (uncoloured), it was impossible to discover from what material the spirits were extracted. It was consequently found advisable to use two, instead of three, rectifying vessels, and to change the mode of action in order to retain more flavour in the rum. In this case 10 per cent. in quantity was said to have been gained over the returns by the mechanism previously in use. The following testimony of Mr A. M'William, addressed to Mr Shand, dated Killitts, 18th May 1831, will explain this result:—

"I have much pleasure in acquainting you that your Patent Rectifying Apparatus has been lately applied to the large common still here, and that thirty puncheons of rum have been distilled; since then a few puncheons of which, with some distilled in the old way, with the aid of a metal retort, have been shipped on board the ship William Bryan, to sail in a few days, so as to reach the market early.

"I feel much gratified in being able to report to you, after a sufficient trial of this apparatus, that it has succeeded to your utmost expectation, the spirit obtained from it at one distillation, being much stronger and infinitely purer than that obtained from the still and retort. It is quite free from any empyreumatic flavour, or that arising from the essential oil when not properly separated, and although highly concentrated and strong, it is by no means fiery, and, I trust, will be highly approved of. In order that the purity of the spirit may be the better ascertained, I have sent one puncheon as it came from the still, without any colouring matter being mixed with it.

"Besides the improved quality, there is a very great economy of time and fuel, as no more weak spirit is obtained than is necessary to put into the tubs at the next operation, and the same work is now performed in ten or twelve hours, which used to take sixteen or seventeen, when using the still *with the metal retort, and wooden condenser or wash-heater*, and the saving of both time and fuel is of course infinitely more over the old mode of re-distillation, or doubling the weak spirit first obtained. I found no difficulty whatever in

affixing the rectifying tubs to the still, without altering or interfering with it. This apparatus is so simple, that it can be easily applied to any common still by an ordinary tradesman, and as the copper domes are small, they can, as well as the tubs, be readily repaired in this country; it has a most decided advantage, both as to economy and convenience, over the more complicated inventions, which are not so easily understood by the Negro distillers, and are apt to become irreparable after some years' use in this country."

In the year 1832, a similar apparatus was in like manner used in Hayti, and a report of the results is contained in the following extract of a letter to Mr Shand from Mr Richard Towning, dated Aux Cayes, Hayti, 25th July 1832, by which it appears that a gain of from 12 to 15 per cent. over the common still was claimed.

"About a month ago," says Mr Towning, "we commenced operations with your patent apparatus, and the result has been most satisfactory. I believe that you are aware that the stills for which I have your apparatus are, one of 900 gallons, made by Lushman and Welsh of Liverpool, which I brought out with me, and a modern flat still of 460 gallons, which I have worked for several years past. As it is necessary to leave a space for the expansion of the spirit, the charge is only 700 gallons, the exact size of my fermenting vats for the large still, and 350 gallons for the small one. I set at 15 per cent., which is, consequently, 105 gallons of the syrup or molasses of the country, made from cane juice, boiled to the consistency of the molasses extracted from the sugar in the British colonies; this produces from 80 to 90 gallons of high wines, 17 proof, the returns depending on the quality of the syrup, and reduced, with pure water, to proof 22 of the Glasgow bubble used in Jamaica, gives from 100 to 110 gallons of rum, most assuredly from 12 to 15 per cent. more than I have ever obtained from the same quantity of molasses during twenty years' residence as a distiller in this country. I ran off each still twice during the day, beginning at six o'clock in the morning, and finishing it at about four o'clock in the afternoon, although three times a-day might be effected with ease during daylight. The still comes down at (42, O. P.) 17, and continues at that proof nearly the whole of the running. When the bubble 19 rises in the safe, which is affixed at the end of the worm, we consider the rum as done, and the remainder of the distillation as low wines, of which we obtain 50 gallons from the large still. These low wines are put into the retorts or rectifying vessels at the succeeding operation, or rather in the retort next the still. This saves trouble, and as the bottom of these vessels are on a level, by opening the communicating cocks, each retort gets its proper proportion—not the smallest portion of spirit remains in the rectifying vessels, and at the end of the operation the residue is thrown away. The quality and flavour of the rum is very superior; and, to use the expression of some of the most intelligent people of this country, its effect is indeed wonderful. To prevent misconstruction, I ought to have stated before, that seven-eighths of the running being strong 17, and only the last ten gallons 18 and 19, the whole product is 17 proof. The low wines

from 28 to 30 proof. I sincerely congratulate you on the success of your invention, and beg to express my sense of obligation to you for the very handsome manner in which you gave me the use of it."

A set of apparatus was attached to a small still, and wrought at Fettercairn Distillery in Kincardineshire in February 1832; but the distillers having used a wash-still with an extremely foul worm, the spirits were, of course, contaminated. This occasioned a difference as to who should bear the loss arising from this cause, and delay ensued; but it was again used in the same distillery in the beginning of 1833, when a superior whisky, and more in quantity, was produced than had previously been made with the common still, as will appear by the following certificates from dealers in the great towns, and others in the Fettercairn district.

In a note from Mr James Durie to W. Shand, Esq., dated Fettercairn Distillery, 7th February 1833, he says,

"You will be pleased to learn, that the returns from our wash is beyond what is termed undue excess; and that the apparatus performs, in every respect, as could be desired."

Messrs James Dallas and Co., and Robert Mitchell and Co., spirit-merchants, Edinburgh, thus expressed themselves on 9th February 1833:

"We have examined the samples of malt aqua furnished by Mr Shand. We consider No. 2. to be the best spirit, being the one most highly rectified. We are of opinion that this aqua is as good as any fine malt aqua in the market, and worth 6d. to 8d. per gallon above the market price of common malt. This, of course, is easily ascertained at all times."

And Messrs William Robertson and Joseph Hague, spirit-dealers, declared that they

"Never saw any whisky they would prefer to the sample produced, either in taste or flavour."

Testimony of an unprofessional character was also furnished.

"To Messrs J. Stewart & Co.

"Sirs, *Bonharry, Feb.* 18. 1833.

"I beg to hand you prefixed, the opinion of four very respectable persons, as to the quality of the whisky distilled by Mr Shand's apparatus, and which they drank at my house last evening; I must mention that one of the four subscribers called at my house this morning, and said he had never taken so much toddy without experiencing a headache and other inconvenience, as he

had done with that made with the whisky distilled with the patent apparatus, at Fettercairn. I am, &c. JAMES ADAM."

"SIRS, *Bonharry, 17th Feb.* 1833.

"At our friend Mr James Adams's, we, this evening, partook of some toddy, made with two different kinds of whisky; the one we were informed was distilled in August last, with the common still, in the usual manner, and the other only few days ago, with Mr Shand's patent apparatus—the latter, to our taste, is decidedly the most agreeable; and we consider it to be a very pure wholesome spirit, and equal in flavour to any we ever drank of two or three years' old. It is proper to remark, that our opinion was given previous to the difference in the whisky's being explained to us. We are, &c.

"JAMES ALEXANDER, Hallhill.
HENRY BROWN, of Balfour.
JOHN LINDSAY, Achmull.
WILLIAM WILLCOCKS, Bonharry."

There is also this professional certificate:

"*Brechin, March* 6. 1833.

"We, Charles Will and Colin Richard, spirit-dealers at Brechin, certify, that we have examined with great care, and tried by a variety of tests, a sample of whisky handed to us from the Fettercairn Distillery, and which sample was made by Mr Shand's patent apparatus, now established at that place. We have no hesitation in stating, that the whisky is a most excellent and pure spirit, and superior, in our opinion, to most of that made in this neighbourhood. We certify, that the spirit made by Mr Shand's apparatus at Fettercairn is better than any we ever before tasted from that distillery. We may add, that the sample we tasted was fresh from the still; and we can assert with truth, that we never tasted a spirit so newly made any thing like it, and there is every reason to suppose that it will rapidly improve by age."

The distillers, however, insisting on payment for the foul spirits, occasioned by their own mechanism and neglect, and expecting that this favourable testimony would induce the patentee to submit to the payment, again ceased to operate with the apparatus.

A similar set of apparatus was, in the end of last year, attached to a still, and wrought in the Glenmurray distillery, near Stirling, by Messrs James Cummins & Co., which, according to the books of the distiller, for a considerable time yielded an average of eight per cent. beyond what the saccharometer indicated in the wash, and consequently beyond what is the product of other stills, and the spirits were, in quality, superior to any ever produced in the same district. The products subsequently to last December have advanced, and vary from eight to twelve per cent. above what, according to the test usually made, the wash is supposed

to contain and to yield, when the process of distillation is carried on by means of the common still.

The following certificate of Mr Thomas Buchanan, general agent, 28. Miller Street, Glasgow, is given of the quantity and quality of the whisky distilled at Glenmurray after inspection of the distiller's books, of date 28th December 1836 :—

"I have inspected the books of the Glenmurray distillery, and find that the quantity of proof spirit contained in the wash there is, according to what is exhibited by the saccharometer, four per cent. under the legal proportion of two gallons of proof spirit to every bushel of malt, whilst the actual return obtained is an average of eight per cent. of proof spirits over what the saccharometer indicates. There is in this case a saving of malt-duty of 1s. 3½d. per gallon, or 5s. 2d. on four per cent.; and according to the price at which this whisky is sold, 8s. 5d. gross, leaving 4s. 4d. gross, there is a clear gain on the quantity of L.1 : 14 : 8, or L.1 : 19 : 10 on the 100 gallons, including malt-duty of 5s. 2d. This, however, supposes the spirits to be at proof, whereas they are sold by me at 11 O. P., which will reduce the clear gain on 100 gallons to L. 1 : 15 : 10½. The above does not embrace the consideration of 9d. per gallon which the Glenmurray whisky commands in this market over common malt whisky."

It is clear, from what has already been shewn, that the principles on which this apparatus are constructed are more scientifically correct than in any previously used. In many instances, what have been held forth as improvements in the apparatus hitherto in use, afford no material gain in time, fuel, or labour. Indeed, the returns exhibit, in many instances, an average deficiency in the proportion of alcohol obtained from the old common still, of not less than three per cent., whilst the quality is by no means improved. On the other hand, this mode of distillation has been proved to gain in distillation an equivalent of 1,000,000 bushels on the barley used in the distilleries of this country.

Occasionally, spirits have been made by this mechanism much too pure to be approved of as whisky; nor is the quantity lessened in effecting this, or any additional consumption in fuel or labour incurred. These circumstances prove, that, not only may a further saving to a very great extent be made in producing a rectified spirit, by a single operation, from the wash, and, consequently, a saving to the country in the economy of grain; but, being equally easy, and attended by no increased expense, to produce

a wholesome spirit instead of the deleterious matter at present distilled and distributed in quantity, there would be no hardship imposed on the distiller to compel him to prepare spirit of a certain degree of purity. He would be more favourably circumstanced than the vender of unwholesome food, such as beef, pork, butter, &c., whose commodities may be affected by natural and unavoidable causes, to which the distiller cannot appeal, as the product of deleterious spirit could only be occasioned by his own neglect.

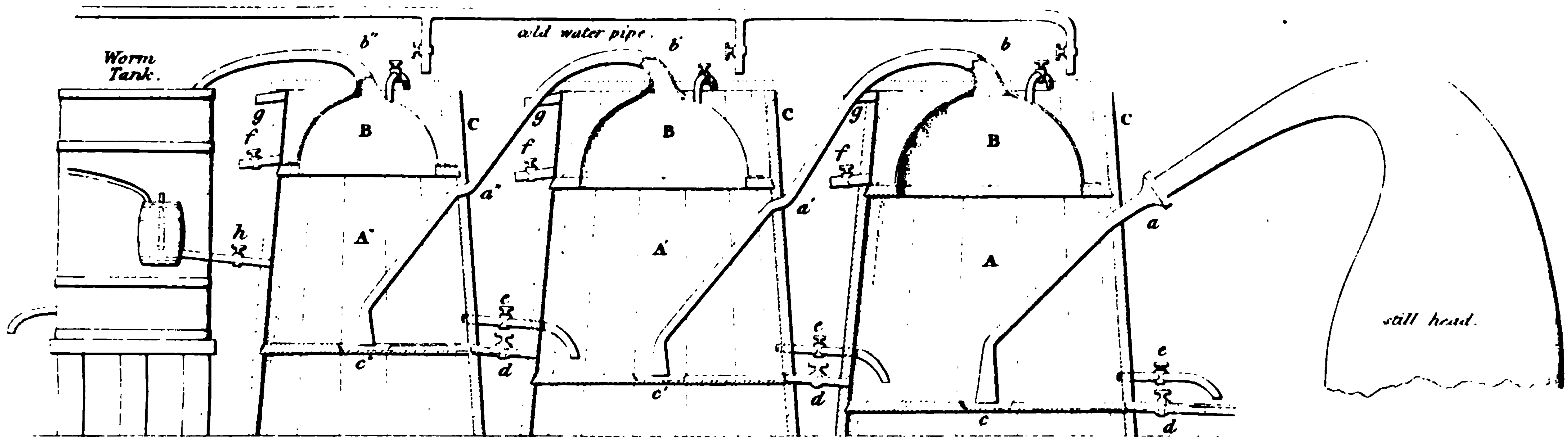
There is another view which may be taken of this subject, During the past year, the sun has been so clouded by a moist atmosphere, and the ground saturated with rain, that the fruits of the earth, in many situations, were destroyed, and are every where less nutritious than usual. Nor has this dispensation been limited to Britain; and, should similar natural causes produce similar effects in the ensuing season, possibly in an aggravated degree, economy in the food of man merits serious consideration.

What has now been animadverted on rests on fact and experience, not on theory or speculation. J. N.

THE LATE SIR JOHN SINCLAIR.

Memoirs of the Life and Works of the late Right Honourable Sir John Sinclair, Bart. By his Son, the Rev. John Sinclair, M.A., Pemb. Coll. Oxford, F.R.S.E. Author of Dissertations Vindicating the Church of England; an Essay on Church-Patronage, &c., in Two Volumes. Blackwood & Sons, Edinburgh: Cadell, London. 1837.

HAVING already, as in strict duty bound, recorded in our pages an outline of the services which the late Sir John Sinclair rendered to husbandry, in almost all its different branches; and having assumed for him a place in the first ranks of the benefactors to agriculture, whether we regard the present or preceding ages, we have not left ourselves room to say much on these admirable volumes. In the memoir which we laid before our readers, we necessarily restricted ourselves, almost entirely, to a consideration of the claims which the memory of the illustrious Baronet unequivocally possesses, not only on the proprietor, but



Drawn by A. Pritchard
263 Strand.
London.

MR. SHAND'S
PATENT RECTIFYING
STILL.

on the farmer of land, and thence on the public at large. To record, as they ought to be recorded, his unwearied and multifarious exertions in the cause of mankind in general, in the promotion of science and literature, in the dissemination of truths calculated to benefit the temporal or eternal interests of his fellow men, did not primarily come within the sphere of our lucubrations, and we regretted this the less, as we knew the task was in the more competent hands of the author of the work before us. Nor has "The Life of Sir John Sinclair by his Son" fallen short of our expectations; on the contrary, high as these were, it has greatly exceeded them. We have seldom perused a biography at once so replete with instructive as well as amusing information. In politics, it opens up secrets connected with several successive Administrations of Great Britain, and we have personal anecdotes regarding the formation and the management of cabinets, now for the first time submitted to the world; and, when we say, that these are connected with the names of North, Erskine, Thurlow, Burke, Pitt, Fox, Wyndham, Wilberforce, and many others of their distinguished contemporaries, we know the degree of interest which must be universally attached to them. Nor less curious are the many traits of character and conversation, which the Rev. Mr Sinclair has here for the first time given to the world, illustrative of the literary and scientific men who adorned the latter half of the preceding century, as well as of the present. The anecdotes connected with the names of Dr Johnson, Dr Adam Smith, Bishop Watson, Mr Pitt, the Presidents Washington and Jefferson, and many others, are extremely valuable; while, at the same time, they give the work a freshness and piquancy, which remind us of the pages of Spence, Boswell, and Lockhart.

As a specimen of the work adapted for our pages, we give the following, concerning the establishment and success of the Board of Agriculture, more especially as it embraces letters from our gracious Sovereign himself, and from Sir Humphrey Davy.

"In what degree this generous ardour in the cause of husbandry and internal improvement was fostered and matured by the exertions and examples of the Founder of the Board of Agriculture, may be seen from the following letters from the author of The Treatise on Rural Affairs; from a learned professor now alive; from a late distinguished philosopher; and from an il-

lustrious personage, whose sentiments on all topics connected with the national welfare must be deeply interesting to every subject throughout the empire. Writing to Sir John Sinclair on high rents, Mr Brown says, 'Had you not called the spirit of the country into action, and induced the tenantry to think as well as act, such rents would never have been thought of.' Professor Low designates Sir John 'the individual who has rendered the most essential services which any one has ever had it in his power to render to the agriculture of this country.' On another occasion he says, 'there is no one so justly entitled to speak of the claims of agriculture as you, whom all Europe admits to be its most zealous and distinguished supporter."

From Sir HUMPHREY DAVY.

Jan. 6. 1809.

"DEAR SIR,—I am much obliged to you for the important document you had the kindness to send to me.

"Amongst the various monuments of patriotism which you have raised, and for which posterity will bless you, this will not be one of the least useful. It is surprising that it should be so much more easy to make men attend to their pleasures than their interests; yet, till within the last fifty years, agricultural economy was a dead letter. I hope you will live to see England independent of all foreign supplies. I can hardly conceive a greater or a more grateful triumph for you.

"We are going on with the plan for the Royal Institution, and I trust it will become, with the assistance of the dignified and patriotic character of the country, a great and permanent establishment. I am, dear Sir, with the highest respect, your obliged servant,

H. DAVY."

From His Royal Highness the Duke of CLARENCE.

"DEAR SIR, *Bushy, Nov.* 20. 1801.

"I heartily agree with you, that this country might, by attention to its agriculture, commerce, manufactures, and above all, its fisheries, become not only the admiration and envy, but also the school of the universe. Without flattery, you were the first man of fashion that began the improvement of husbandry, and I have only the merit of being one of your most zealous followers. Ever believe me, dear Sir, yours truly,

WILLIAM."

"DEAR SIR, *Bushy House, Feb.* 22. 1827.

"Last night I received yours of 18th inst. from Edinburgh, and its accompanying statement, for which accept my sincere thanks. Every nation ought to pay all possible attention and give every encouragement to agriculture. I must feel most sensibly the kind expressions you use in your letter towards myself, and wish from the bottom of my heart, I had been of that real use to our country that your worthy self has been, and most particularly at the head of the Board of Agriculture. I remain yours unalterably,

WILLIAM."

'The usefulness of this great central institution radiated to the remotest dependencies of the British crown. In Bengal, the chief agricultural deficiency had always been the scanty support for cattle and horses. On the suggestion of the Board, lucerne and Guinea grass were tried with success. I find the

Court of Directors, in a dispatch to Marquis Wellesley, the Governor-General, expressing their satisfaction at the prospects of those productions becoming 'an invaluable acquisition to the Bengal provinces.' I have not hitherto been able to ascertain how far this expectation has been realised. An eminent botanist, however, informs me that he received, some time ago, good specimens of lucerne from Calcutta, though he was not aware, till I informed him, how the plant had been introduced. The Board likewise caused experiments to be made in the cultivation of potatoes and of hemp in the East Indies. For the improvement also of the West Indies, they transmitted a collection of seeds from Sumatra to Jamaica and St Vincent. This collection proved so acceptable, that the House of Assembly in the former island passed a vote of thanks to the donors. The Board was also the means of introducing into those islands that important article of ship-building, the teak tree.* I have much satisfaction in adding, that the West India body, both collectively and individually, took every opportunity to express their gratitude to Sir John for his various exertions to promote colonial agriculture.

"The President was able to be more useful in this foreign department, by securing the assistance of numbers for whom he had procured situations in the colonies. To those who expressed gratitude for his patronage his usual answer was, that all the return he asked would be to receive from them information or productions that might be useful to husbandry, either in other settlements or at home.

"The interest taken in the proceedings of the Board was fully as great in all parts of continental Europe as in Great Britain itself. I have already noticed, that M. Otto, the French ambassador from the Consular Government, applied, in 1800, to the President, for a list of such works relating to agriculture as were most likely to promote the internal improvement of France. While complying with the request, Sir John enclosed copies of a paper which he had then recently drawn up on experimental farms, together with some plans of circular cottages, and of a country village. His plan and papers were submitted to the National Institute, which appointed two of its own members, Messieurs Tessier and Cels, to examine and report upon them. These eminent savans, not only gave a highly favourable report, but took occasion to express, in strong terms, their admiration of Sir John Sinclair's exertions in the general cause of humanity. The Institute voted him their thanks, and ordered his communication to be printed and circulated among the members. M. Tessier, in other instances, was quite eloquent in his eulogium of the Board. 'True citizens' said he, 'men who judge wisely, the cordial friends of France, cannot see without a noble jealousy, England forming a Board of Agriculture. There is not a wise man, and a friend of humanity, who will not applaud with me, operations so well concerted, and so promptly executed.' A number of my father's works were either abridged, as I have already noticed, in the Bibliothèque Britannique, or translated entire into various continental languages. He received diplomas from many of the philosophical, and from all the agricultural societies of Europe; he carried on an extensive correspondence, not only with Tessier above-named, but with Lasteyrie, Silvestre, Maurice, Pictet, Hertzberg, D'Einsiedel-

* See Arthur Young's Lecture to the Board, pp. 58, 59.

Voght, Edelecrantz, Hauterive, and other noted patrons of his favourite science; he was, moreover, in the habit of receiving visits from foreign students of agriculture, who anxiously consulted him on the subject, having come from the most opposite extremities of Europe, from Finland or Calabria, from Volhynia or Andalusia.

"Nor was America less alive than Europe to the benefits resulting from this rich and varied storehouse of agricultural knowledge. Washington recommended an American board of agriculture, constructed on the plan of that in England. And, although a national establishment of this nature was not founded for the whole Union, yet his suggestion was adopted by the State of New York, which, in 1819, appropriated out of the public treasury 10,000 dollars annually for the improvement of husbandry. The success of this institution was universally acknowledged in America. An intelligent country gentleman, of the State just mentioned, G. W. Featherstonehaugh, Esq. of Duanesburgh, thus writes to my father:—'In promoting agriculture, we have imitated Great Britain, as in many of her other prominent arts and sciences; and these interesting circumstances give additional strength to that natural bond between the two countries, arising from family connexions, similarity of language, mode of living, customs, &c., which, I trust, will always unite them in the successful pursuit of all those objects which tend to render human life dignified and desirable.'

"To give some idea of the confidence with which foreign agriculturists relied on the judgment and philanthropy of Sir John Sinclair, I may here introduce a few specimens, such as first occur to me, of the requests, queries, and suggestions transmitted to him from all parts of the world, and in many instances by persons whom he had never seen or heard of. Major Stjeonswand asks advice as to the proper method of improving ten thousand acres of rich land in Egenhole in Sweden. M. Collett of Christiana offers an account of his experiments at Ullevold, in Norway, for insertion among the transactions of the Board. M. Ankar of Copenhagen inquires, how noblemen from Denmark may obtain instruction in British agriculture. The Chevalier Buckhardt of Bavaria desires to have a list of English works on husbandry, particularly on the breeding of sheep and horses. M. Von Hoffen, of Idolsberg, in Austria, solicits information with respect to thrashing machines and distillation. M. de Liebistor, president of the agricultural society at Berne, wishes to know the rules adopted by the Board with respect to the reward of merit. M. Fellenberg, of Hofwyl, offers to exchange Swiss for British implements of husbandry. M. Serwinski, of Biala, near Warsaw, offers to send a 'socha' or Lithuanian plough, for trial in Great Britain.—Count Zenobio, of Venice, asks for specimens of Shetland rams, and offers rams from Pavia in return. Mr Robert Sinclair, of Baltimore, in Maryland, describes minutely the soil and situation of his transatlantic farm, and inquires the best rotation of crops and instruments of tillage. Lastly, Mr William Dunn, of East Florida, is desirous of information as to the style of culture most adapted to a sandy soil."

The task imposed upon the Rev. Mr Sinclair of being his father's biographer, was certainly a delicate one, but he has

executed it in a way entirely honourable to his talents and good taste. With the utmost natural admiration of his distinguished father's labours for the good of the human race, he in no instance puts forth a claim for him, which he is not able to substantiate; nor does he ever attempt to elevate him at the expense of others. On the contrary, he has chosen the more modest, but certainly not less efficacious plan of detailing facts, and leaving these to plead their own cause. Even in the general summation of his character, he does not allow his filial partiality to overstep the boundaries of that homage, which we dare say even the most backward are more willing to pay to the memory of the Founder of the Board of Agriculture.

"In the intellectual character of Sir John Sinclair," says his biographer in concluding his memoirs, "the leading features were fertility of invention and indomitable perseverance. He was rather a man of talent than of genius; he occasionally amused himself with poetry, but was not successful in that branch of composition. As a speaker he was argumentative and emphatic, but not brilliant; better fitted to convince than to persuade. During his career in Parliament, the House of Commons was accustomed to the most magnificent efforts of rhetorical power; to such he never aspired. Both his taste and his judgment led him to prefer clear business-like statements and solid reasonings. Occasionally, indeed, we find a passage in his speeches rising to great eloquence, but his ordinary style was calm, argumentative, and unostentatious. His earlier writings are confessedly superior to his later compositions; they possess more energy, and are unencumbered by those minute subdivisions which, though adopted for the sake of perspicuity, sometimes embarrass and fatigue the reader. His works are voluminous, but notwithstanding this disadvantage (for such it often is), they are redundant rather in facts than in words. The information he accumulated upon the various subjects of which he treats, is immense; for he studiously improved every opportunity of acquiring knowledge, and endeavoured to make every possessor of it, to whom he could gain access, a contributor to the general stock.—Few men knew so well how to elicit information from persons least habituated to communicate their ideas.

"The value of his long-continued labours was acknowledged by all classes, both at home and abroad. King George III. bestowed upon him the rank of Baronet, admitted him a member of the Privy Council, and was understood to have intended for him higher marks of royal favour. Twenty-two counties in Scotland voted him thanks for his services to agriculture, and their example was followed in various towns, by the inhabitants of which he was regarded less as an indefatigable friend to husbandry than as a general benefactor to his country. He was received into a large proportion of the literary, scientific, and agricultural societies at home, and his list of foreign diplomas amounts to twenty-five.

"It was chiefly by adherence to the strictest rules of temperance, that Sir John Sinclair, with unimpaired faculties, outlived the ordinary term of mortal existence. During his long life, he never once transgressed the rules of sobriety. Having ascertained the kind of diet best suited to his constitution, he adhered to it from year to year with undeviating regularity. His chief imprudence regarded expenditure. He forgot limited amount of means, when objects of great national interest were to be secured.

"No patron could have greater zeal for advancing the interest of his friends, or for encouraging meritorious individuals, however obscure in station or depressed in fortune. About two hundred persons owed to him their success in life.* He never cherished enmity towards those who opposed or injured him. He was even blamed for not distinguishing sufficiently between supporters and opponents, friends and enemies. He envied no man's reputation, but was eager to advance it whenever it was well deserved—a generosity which he did not always himself experience. He was no violent partizan; but admired talent and worth in men of all political sentiments; and, although a hearty and zealous patriot, he never permitted national rivalries nor antipathies to bias his moral judgment in the case of individuals. His charities were, perhaps, too indiscriminate. He was unable to resist importunity, even of suspicious applicants; and, although in theory a political economist, on the side of feeling he was a Christian.

"His piety shrunk from all display. He cherished a habitual reverence for the Supreme Being, and abhorred all approach to profaneness. He had, indeed, at one time, partly substituted usefulness to mankind for those high religious motives which are the only true foundation of beneficence; but he happily learnt afterwards to discriminate between external conformity to moral rules, and a complete devotion of the soul to its Creator; he learnt to acknowledge, that a moral agent may even deserve applause from men, while, in relation to the purity and majesty of God, he stands guilty and condemned. In the doctrine of Christianity, my venerable parent saw the only ground of religious hope, and rising from the mere intimation of nature, to the assurances of revelation, anticipated, with humble confidence, 'the life and immortality brought to light by the Gospel.'"

In an appendix we have a catalogue of the various books, tracts, and papers published by Sir John Sinclair, and these amount to the extraordinary number of three hundred and sixty-seven! Even this, Mr Sinclair adds, is probably incomplete, but the list comprehends all those, of which he himself happened to preserve copies.

In parting with this book, and with its illustrious subject,

* When it was reported to him that one of his beneficiaries had said, "Sir John did no more for me than write a letter," his observation was, "Little does —— think how much care, and toil, and expense it has cost me to have the power of writing such a letter."

we have but a few suggestions to make. To what was the greater part of Sir John Sinclair's fortune devoted? To the promotion of agriculture. To what was the greater portion of the late Sir John Sinclair's life devoted? With enthusiastic and unwearied perseverance to the improvement of husbandry. Has any man in any age or nation ever done more for the cultivation of the soil, for extending the means of the earth's fertility, than the late Sir John Sinclair did? If such there be, let him be named, for we know him not.

Callous as the public may for a time be to the claims of merit —thankless as the world may for a time seem, to even its best benefactors, yet it is cheering to think, that seldom or never has pre-eminent desert been ultimately deprived of its honours. Certainly, with regard to the distinguished projector of the Statistical Account and founder of the Board of Agriculture, this day of public acknowledgment has not yet arrived; and proud would be our feelings, could we suppose ourselves the humble but helping instruments in a cause, which we sincerely think to be less a generous, than a just one. If ever man deserved a public testimonial of invaluable services rendered to the community, Sir John Sinclair is that person. May we not most respectfully suggest to the Highland and Agricultural Society of Scotland, that it could not be unbecoming in them to take a lead in this matter. Were subscriptions limited to a guinea, to make the thing as general as possible; and if the District Agricultural Societies throughout Scotland were called into co-operation, we have not the smallest doubt, that a sum would be shortly raised, which would honourably evince the farmer's gratitude for the exertions of Sir John Sinclair, and Scotland's pride in having produced such a son.

Without delay a committee should be appointed to regulate the detail of a matter so intimately connected with the national character and honour. Let it be column, statue, or bust,—we care not which, only let us feel aware, that among survivors there are some "zealous for a good man's fame."

ON POTATO FAILURES.

The Potato Rescued from Disease and Restored to Pristine Vigour, by a plan of Keeping and Cultivation founded on the Natural Principles of the Vegetable Economy. By William Aitken, Castle Douglas. Blackwood & Sons, Edinburgh: T. Cadell, London. 1837.

The Failure of the Potato Crop ascertained and demonstrated from Analogy; with a Remedy and Test for the Present Seed to prevent Failures. By a Dumbartonshire Farmer. John M'Leod, Glasgow. 1837.

It is too late in the period of its history to expatiate on the importance of the potato. Suffice it to be known that it is an essential ingredient in the national food. Any circumstance, therefore, which might detract from the prolificacy of its reproduction, commands serious consideration, and should excite national alarm. Grounds for such alarm have manifested themselves, and their investigation, philosophically and practically, demands the combined efforts of the man of science and the farmer. We are not aware that the cause of the potato failure has hitherto been investigated by scientific men, but the extensiveness of those failures, of late years, pressing hard on the interests of the cultivator, has impelled *him* into the investigation, with the urgency of necessity. The maxim *felix qui potuit rerum cognoscere causas*, is true, whether the investigator of causes be a man of science or a man of practice; but the latter too easily rests satisfied with the degree of happiness derivable from the discovery of only secondary causes; and they are they which are most obviously connected with his daily operations. The explanations of potato failures hitherto tendered by practical men, have, therefore, been based on the results of secondary causes. The numerous authors of the various papers which have been transmitted to the Highland Society on the subject, have merely criticised various portions of subsidiary practice, which, under the altered condition of the potato, no doubt require amendment, and thus contenting themselves, have not extended their observations to the source of the evil. It is worth while to trace their workings within the boundary of secondary causes, beyond which few have thought it necessary to pass; and a few instances of expressed opinion will perhaps sufficiently illustrate the limited observation which they have taken.

One writer, for example, affirms, that the potato failure arises from the seed having been heated by being kept in too great quantities in pits or houses; but large quantities of potatoes have been kept in pits or houses, and to a great depth, too, long before the appearance of the potato failure. And yet the fact may be, that potatoes are now heated in pits and houses, and will not in consequence grow. But what was *that* which enabled the potato to escape failure until lately, even when kept in depth in pits or houses? Another asserts, that cut sets become heated in large heaps, and will not, in consequence, grow. It is very possible that cut sets become heated, while lying for a time in large heaps on the barn floor. But who has not seen, until lately, large heaps of cut sets waiting with impunity for weeks until they were planted? What was *that* which enabled the cut sets to escape failure then and be overtaken with it now? A third ascribes the failure to the manure being in a fresh state when brought in contact with cut sets. We have frequently seen old straw-ropes laid along the drill raise excellent crops of potatoes; and who has not seen horse-dung taken out fresh from the court, and applied to potato-land without incurring, until lately, a risk of failure? It may be, that fresh dung now destroys the vitality of the potato set, but what was *that* which prompted the cultivator then to disregard the state of the manure when applied to potato-culture? Another writer is certain, that dry weather in the time of planting, and a continuance of it afterwards, destroys the vitality of the sets and causes the failure; and thus he blames the dry weather of the last three years for the failure. But who, that has lived some time in the world, has not seen many dry springs before those of the last few years, and long before the potato-failure was known? There have been few years which can be compared for drought with 1826, and yet no cultivator experienced potato failure that year. We had then the misfortune to farm gravelly soil, and could the combined agencies of heat and dry soil cause failure, our potatoes could not possibly have escaped it; for when they were setting, the ground felt as if scorched with fire through thick soled shoes, and the dung was almost dried to a potsherd before it could be got covered in with the utmost expedition, by people and horse, and yet no failure occurred, nor was any appre-

hended. But it may be that heat now destroys the vitality of potato sets, and yet what was *that* which enabled the sets to escape with life in 1826, and yet perish by the milder droughts of the last three years? To avoid failure, many recommend sets to consist of whole potatoes, or, if cut, to be placed on the dung on the skinny side, or to be planted during the cooler part of the day, in the morning and evening. These precautions may now, no doubt, be very proper and necessary, but why were they not necessary years ago? What is *that* which enabled the cultivator formerly to disregard these precautions? Some conceive that the land having been too much cropped with the potato, has become sick of its growth, as in the case of red clover. Whatever force this observation may have had some years ago, when the land was constantly stirred and cropped, it cannot so forcibly apply to the last three years, because the rotations now permit a longer term to grass, and land, in general, is treated with greater leniency and manured more liberally than ever? What is *that* which enabled the potato to defy failure when the land was constantly over-cropped and under-manured?

As long as such diversity of opinion exists on the cause of the potato failure, it is obvious there can be no community of purpose among the holders of these opinions, who are also the cultivators of the potato, to discover its probable cause; for the prevalent belief that one effect, that is, the same failure can be produced by so many, and some of them opposite, causes, as we have enumerated, must be founded on improbability, and not on the laws which regulate other natural phenomena. Guided by his peculiar belief, each cultivator may, no doubt, so contrive to manage his potato culture, as to avoid for a time the most aggravated failure; but he cannot assure himself of safety for even one season, far less can he depend on the infallibility of his management for a series of years. Whichever of those peculiar opinions he may have adopted, he will most probably be obliged to relinquish it, and adopt those of other cultivators, perhaps the very one which he had formerly ridiculed. In adopting this change he may nevertheless feel satisfaction, that he is obeying the dictates of experience, though not of his own. But the time will at length arrive when he will be wearied pursuing so many desultory practices, even although they should all have

been sanctioned by experience. In his perplexity he will probably be tempted to ask himself, what is *that* which makes so many methods, hitherto acknowledged excellent, of raising potatoes, all terminate now in failure? Were the question repeatedly asked by cultivators, whether at themselves or others, a hope might be cherished that the spirit of investigation was about to dwell in their bosoms, and the result might be anticipated that the light of philosophy was about to illumine the operations of the field.

But some cultivators have already been asking themselves the question proposed; and the response which they have received consists of conjecture, whose probable accuracy derives confirmation from daily experience. The conjecture has the merit of explaining all the phenomena of failure, and reconciling their discrepancies. It can appeal to analogy for the correctness of its principle, and, admitting that its application to potato culture may, in time, be proved to be untenable, the practice founded on it, in the mean time, can entail no loss or inconvenience to the cultivator. The conjecture is, that the potato, as a plant, has lost its constitutional vigour. We give this principle of the failure at present no higher pretensions than of being founded on conjecture, but if it, like many theories which have sprung from conjecture, be confirmed by subsequent experiment, it will deserve to be invested with all the authority of sound theory. Now, let us apply this conjectural principle to the various phenomena exhibited by the failure, and thereby ascertain whether they are explicable by the theory of constitutional decay: For example, are potatoes now heated when stored in depth, in pits and houses, more readily than formerly? it is, because being constitutionally weaker, they are less able to endure the rough treatment of former times. Are cut sets now easily heated when lying in heaps? the same reason will explain the circumstance. Does dry manure now effect potato failure? it is because the weakened sets are unable to resist, to them, the mortal effects of active fermentation in the manure, until the manure has incorporated itself with the soil? Does a scorching drought now produce potato failure? it is because the intensity of the heat actually deprives the sets of vitality, in their present debilitated condition. In short, take the sets under every circumstance of fail-

ure, let them fail when planted at mid-day, and grow when planted in the morning and evening; let them fail when the cut side is presented to the dung, and grow when the skinny side is so placed; let them fail when cut, and grow when planted whole, when the skin, as in the last instance, acts as a protection to the pulp; let them fail when planted in dry soil, and succeed when planted in damp, where their natural sap is retained, the same principle of constitutional weakness will explain every one of these phenomena, for every instance of failure occurs in situations more likely to be fatal to the vitality of the sets than in situations in which the crop succeeds. No doubt, each of the multitude of secondary causes, such as heating of the seed, heat of the sun, dryness of the manure, and many others, will also explain one or more of the phenomena of failure; but the confidence of the cultivator will be shaken in them all, when he discovers, in his endeavours to avoid one cause, by a particular change of culture, he may suffer from the effects of another, for *all* his precautions, suggested by these numerous causes, may not insure him against disappointment. Although armed with every precaution, he plants his crop in dread. He may conceive he may, but he can only with a trembling heart, pray Heaven to be gracious, for he thinks he has done *his* part; but, in fact, for all he imagines he has accomplished, he has not nearly done his part, nor done that part well. He has confined his observation to the facts which surround him. Like the child who is afraid of the burning embers which have set fire to its clothes, is yet heedless of the danger from the fire itself. Would it not be more philosophical, more like a desire for truth, to extend observation beyond the narrow bounds of daily practice, for explanation of a phenomenon, which assumes, like Proteus, so many shapes within our view? Would it not be more philosophical, more conformable to Nature's laws, to believe that a single principle which evidently effects mutation in living objects, both in the animal and vegetable economy, should account for rather than a plurality of causes, the variations of a mutable phenomenon? This principle is constitutional weakness in the potato, superinduced by a peculiarity of treatment.

But granting that vegetables do decay in constitution by peculiar treatment, how, it may be asked, is it known, or can be

proved, that the potato is yet subject to it? The fact of the failures of the last few years is a *prima facie* proof that a change of some kind has affected the potato. The eager desire of cultivators to prove the heated state of the sets before, or the fatal effects of heat at the time and after planting, under the same treatment, which has obtained for years before the appearance of failure, is a decided proof of the conviction on their minds that a change has affected the potato. But why should a change be thought incredible or anomalous in the potato, when varieties of plants, and even animals, treated in a peculiar manner, are liable to constitutional decay? Many varieties of the potato, as is well known, have passed from cultivation. We may instance a small blue variety, a large white kidney, and a lenticular shaped brown, commonly called, from the appearance of its skin, leather-coats. Many old varieties of apples and pears have disappeared from the garden and orchard, and not a few are expected in a few years to disappear altogether. The Arbroath oslin, the golden pippin, the paradise pippin, the red streak, and the Lammas pear, are all evidently on the decline, not on account of disinclination to cultivate either of these varieties of fruit, for they are all pretty fruit and of pleasant flavour, but on account of the constitutional weakness of the plants themselves, the effects of which is acknowledged by every gardener to be a difficult task to counteract. The Paradise pippin is now chiefly cultivated for stocks upon which to graft new varieties of apples, and most probably the prolificacy of such grafts may be accounted for by the declining condition of the stock, and probably the employment of that variety for such a purpose, may prolong its existence beyond its natural endurance of life.

But it may be eagerly inquired, what is this peculiar treatment which superinduces constitutional weakness in vegetables and animals? In animals, too near an approach of consanguinity in their union, invariably produces weakness, and if that kind of union is pursued through several generations, the weakness terminates in disease, deformity, and barrenness. Vegetables are propagated by grafting, budding, cuttings, runners, and tubers, as well as from seed. Varieties obtained from such unions as grafting and budding, indicate weakness after a lapse of time. The crab-apple—the original species—has retained its vigour;

whilst varieties obtained from it by those means indicate symptoms of constitutional weakness in the lapse of time, the rapidity of which is hastened the farther the varieties are removed from the parent stock. Plants, on the other hand, that can only be raised directly from the seed, never indicate weakness, whatever may be their treatment in cultivation. Every variety of grain, grass, cabbage, onion, and many others which are directly propagated from the seed, is as healthful in constitution as when originally obtained, and will endure every sort of treatment. The varieties of these kinds of plants have been obtained by impregnation of the seed, and as they can only be reproduced from the seed, they will remain permanent. But there are plants which, although they may be raised from the seed, are propagated by the other means just enumerated, and when so propagated, indicate symptoms of weakness in the course of time. Varieties of strawberries, for example, may be obtained by impregnation of the seed between any two varieties; but their reproduction by runners, which is the easiest method of cultivation, will in the lapse of time superinduce constitutional weakness in those varieties. Some old varieties of the strawberry are now past bearing, at least they are now not worth the trouble and expense of cultivation, and other more esteemed varieties have been substituted for them, and obtained by impregnation from the seed. Analogy warrants us applying the same reasoning to the potato. Varieties of the potato may be obtained by impregnation of the seed between any two varieties, or directly from the seed itself of any one variety; but their reproduction by tubers, being the easiest method of cultivating the potato, superinduces, in the lapse of time, the period being unknown, a constitutional weakness, as in the case of the strawberry, which renders it unprofitable to continue the culture of that variety. Varieties of plants are more easily produced from varieties than from species, and the more easily they can be propagated, and the more numerous the modes of propagation, the more easily they fall into decay. Of the potato, only varieties can be obtained in this country; for the original species, whether more than one, were brought from Peru. Could a new species of potato be obtained from its indigenous site, its vigour of constitution might be maintained for a series of years, and

the varieties obtained from it would no doubt possess constitutional vigour in a proportionate degree stronger than any of the varieties now in cultivation. It might be a difficult matter to obtain new species of the potato from their indigenous site in Peru, but until such a consummation shall be accomplished, new varieties should be obtained from the seed of those in use, which, although decayable in time, will probably be more vigorous than the older varieties now in cultivation. It is fortunate that this method of reviving the vigour of varieties is in our power, and it should be made available. Let new varieties, therefore, be raised from the seed, and tedious as the process may be, let it be pursued with care and perseverance, until varieties are obtained which shall possess the factitious properties of good potatoes. Great circumspection will be required to select the seed from the most vigorous varieties in existence, for that obtained from weak plants, or from weak stems of the same plant, will probably produce varieties which might decay in the course of a short time. To avoid the risks of such a disappointment, experiments should be instituted in various parts and situations of the country. Meanwhile, money could hardly perhaps be expended to more advantage ultimately to agriculturists, than in their dispatching an experienced botanist and shrewd cultivator in search of the original species of the potato, in Peru, haply if such there be now in existence. But besides adopting the tedious plan of raising new varieties from the seed, and obtaining new species from abroad, means should also be employed to preserve the varieties in use from farther decay, by placing them in circumstances to escape the accidents of mismanagement and weather, and pursuing a mode of culture more suitable to their tender condition.

Such are the views which we entertain on the potato failure, and they have undergone no change since the first exhibition of the disease three years ago; on the contrary, we conceive that experience more and more tends to establish their correctness. It is with regret we have observed writers on the failure confining their views to secondary causes, which may be useful in hinting precautions and suggesting palliatives, but which will never enable the cultivator to appreciate just views of the disease. The nature of the disease is quite explicable on the laws of vegetation. These laws are comprehensible by every culti-

vator; and if he would but suffer himself to be more guided by nature, and less by his own factitious notions, his path to right conduct would be quite clear. We are glad in having this opportunity of introducing to our readers the two authors whose brochures form the head-piece to this article, who have ventured to step out of the common route of other writers on the potato failure, and illustrate the subject much in the same way as we have endeavoured to do in the foregoing remarks. The Dumbartonshire Farmer, indeed, little more than suggests the existence of constitutional weakness in the potato, but illustrates his opinion amply from analogy to the changes produced by certain sorts of treatment in the animal economy, and perhaps he urges his analogy betwixt the potato and man too fancifully. What would he say to raising a man by planting a great toe? Mr Aitken's treatise is a finished production, and confers credit on his reflecting and rational powers.

His little work may be divided into historical, theoretical, and practical parts. The historical narrates the history, uses, and habits of the potato; the theoretical demonstrates the liability of the potato to constitutional decay; and the practical contains, among many other subjects, judicious instructions to preserve the potato in winter, cultivate it in summer, and test its vitality before planting in spring, in a manner different from common practice, and yet supported by the experience of some years' practice. The reader must have recourse to the little work itself, to observe the train of reasoning and illustration by which he supports his views, as we have not much room for extracts. From the theoretical department we shall quote these sentiments. After shewing how species are reproduced and varieties originated, and illustrating the permanency of species and the mutability of varieties, he indicates what varieties are vigorous and ..ners necessarily weak.

"I have now further to shew," he says at page 35, "in proof of what I have ..emised, that there are other varieties of cultivated plants, which, from na..ural causes, are *not* liable to decay. This distinction may not be a new ..ne, but I have never seen it stated by any writer on botany; and it is only .. late that it has occurred to myself. I have seen it stated, indeed, that .. plants are liable to decay, which I deny, considering the assertion to be ..ntrary to the fixed laws of nature. The line of demarcation between the two ..ders of decayable and undecayable plants is easily traced, and ought to be ..ced, as the existence of the fact very naturally indicates the remedial mea.. .. necessary to be had recourse to

"The undecayable varieties are all such as are raised *directly* from seed, namely, annual, biennial, perennial, shrubby, or herbaceous plants. In this property they closely follow the law of the species, which *necessarily* renders them enduring. For clearness of illustration, I must here shortly reiterate what has been formerly stated at length, that decayable plants are furnished with two or more methods of propagation. Fruit-trees are ordinarily propagated by grafts, the gooseberry by cuttings, the strawberry by runners, and the potato by tubers. The purpose which Nature has in view in this provision is very obvious, namely, to afford a simpler, and much more expeditious method of increasing, and thereby extending, these her most valuable productions. Nature, however, whilst thus facilitating the extension of such plants by methods so summary, appears to have been at the same time perfectly conscious, that, as they were deviations from her ordinary course, and would therefore ultimately tend to the deterioration of the varieties, it was necessary that plants should be left in possession of the ordinary generative organs, by which they could be renovated as often as the too frequent practice of the more summary methods should render renovation desirable.

"On the other hand, all plants which are not decayable have only *one* method of perpetuating themselves, namely, by the seed. Among these are all the cultivated kinds of grains,—wheat, barley, oats, beans, and pease; with the culinary vegetables,—turnips, carrots, cabbages, onions, and many others. Cauliflower, which is a variety of the cabbage, has been cultivated in Britain for upwards of two hundred years, and has, during all that time, continued in the full possession of its original vigour. New varieties of this and the other individuals above enumerated have been introduced, and old ones set aside. Still the preference was not given because the latter had become infected with disease or decay, but because the former possessed the superior properties of flavour, size, or productiveness.

"I conclude this part of the subject by remarking, that the duplex power of propagation afforded to those varieties of plants which I have classified as decayable, not only goes a great way to *prove* that they are so, but that it is also equally demonstrative of the fact that the others are not so, seeing that they are deprived of the secondary property peculiar to the former, by the operation of which their vigour is ultimately affected."

In the practical department of his little work, Mr Aitken imparts much interesting knowledge in the treatment of the potato in autumn, winter, and spring, derived from his own and the experience of others. He prefers *green* sets to those over-ripened; and proves the efficacy of green seed, that is, seed full of vegetative sap, from the circumstance of the crabs or green excrescences which grow on the stems of the potato forming good vigorous seed. Something analogous to these crabs is the seed when *greened*, that is, exposed to the air until its skin becomes of a *green* colour. Both these expedients, however, are merely temporary in preserving the vigour of the potato.

"Such means," he observes at page 46, "cannot impart to the tubers full vigour, and still less the longevity that is acquired from a renewal of the variety from seed. It will only be efficacious for a year or two. But even this much gained, in the present state and prospect of the potato, is a triumph. When the seed is separated from the ground, great care must be taken to preserve the sap and prevent exhaustion; green tubers being more precarious to preserve than those that have been fully ripened. The earth, however, will preserve them fresh and sound. Nct one is known to rot when left in the ground. No matter at what time they are parted from the parent stalk; they all spring vigorously when the natural season arrives, and not until then."

This fact suggests to our author the plan to be adopted for keeping potatoes in winter.

"The nearest approach," he continues, "that in pitting you make to their natural bed, the greater the certainty of preservation. Keeping this injunction in view, I recommend the following plan:—

"Prepare a pit in a situation free from the possibility of retaining bottom water. Sink it a foot deep, if the soil will admit. The width may be from three to four feet. Spread a layer of potatoes along the bottom not deeper than four or five inches. Then throw over them a stratum of the dry well-broken mould, taken from the pit. Then lay another layer of potatoes of the same depth, and more earth, as formerly. Add a third layer of potatoes, and finish with a gently rounded, not a ridged top, as usual; and, still retaining the rounded shape, cover eight inches of earth over the whole. Cut a trench along both sides of the pit to carry off water. Be sure to have loose earth nearest the potatoes, and allow as much of it as possible to mingle with them. Take care that they be dry when so stored, and that there be no *wet* earth adhering to them, as potatoes laid past in a wet state never keep well. Use no straw on the top, as I wish the earth above the potatoes to know the changes of weather,—to receive damp or drought alternately, in order that, as near as possible, their bed may resemble that in which they grew. I hope my object in the above specified plan will be discernible by every person. Under the ordinary pit or house method of preserving, potatoes begin to grow very early in spring; and when once growth has fairly commenced, they become hot in the close body that is formed by the daily increasing fibres; the growth is more hastened, the heat being more confined by the thick mat of straw which lies betwixt them and the top earth; which earth would otherwise in a great measure extract the internal heat, were any such engendered."

Testing the vitality of the potato sets before planting, is urged by Mr Aitken as an important consideration. This is his method, which, if generally pursued, would obviate the necessity of early planting, and permit time to work and clean the land:—

"Select a piece of dry ground," says Mr Aitken, at p. 53, "in a securely fenced ...; when required on a large scale, as will be the case on extensive farms, lay

the ground off in beds of five feet wide, with alleys of two feet. Use a garden line, and lay them off in a neat manner. From the alleys take earth to cover the surface of the beds, taking care to raise them a little in the middle. This done, have in readiness, and placed conveniently to the beds, a quantity of fine compost earth, consisting of one-third of moss, one-third of clean earth, one-third of peat or coal ashes, mingled with a small proportion of lime, enriched by urine, or pourings from a dunghil. The beds and compost being both in readiness, cut all the seed potatoes which are above the size of a common hen's egg. By the first cut, take off about the fourth part at the root end, and lay it aside for food. Next, divide the top end into pretty large outs, the small ones use entire, either kept by themselves, or mixed with the cuts. When a quantity is thus cut, spread it over the bed, upon which previously is to be laid a thin covering of the compost. I would recommend the layer of potatoes not to consist of more than *two* cuts in depth, spread over with an inch of compost. This done, if the weather be dry, take a watering-pan and water most effectually, in order to wash the compost into the bed amongst the cuts; the quantity of water being regulated by the state of the weather. After this, give them another covering of compost, in all about three inches in depth. In this manner proceed until as many are so laid down as will be required for the farm. Farther watering will only be necessary if the weather is dry. After the cuttings have lain in the seed-beds some time, it will be necessary to examine them to see if they are springing, of which there can be little doubt. If *any* doubts are entertained, however, it will be necessary to prepare more sets, and put them in fresh beds, to insure a sufficiency at the time of transplanting. The chance of the seed springing in the beds is ten to one compared with the ordinary way. Here, should the weather be dry, abundance of moisture can be communicated at any time; and, in place of a parched soil robbing the sets of moisture till they are quite shrivelled, as was the case during the intense drought of last May, the sets will be duly fed and nourished from the fat juices of the rich compost. Allow them to remain in the bed till the shoots come above ground. If the compost has been mixed with lime, as directed, it will act as a powerful stimulant upon the weakened and exhausted vegetative powers of the potato, and very much accelerate and strengthen the young shoots. If this has been neglected, it may still be partially accomplished, either by dusting powdered lime among the cuts, or mixing it in the water. If no compost has been prepared, good clean loose earth will answer the purpose, but it would not be equal in efficacy to a rich well-prepared compost."

After thus describing the manner of testing the seed, Mr Aitken gives minute directions for conducting the field operations in the preparative planting, and for setting the tested seed. The Dumbartonshire Farmer has also a test for discovering the decayable from the undecayable cut sets of the potato. Thus:

"From the now generally diseased state of the potato, it appears to us that there is but one way to test the seed before planting, which, if properly attended to, will prevent those melancholy results that may be anticipated in the crop. It is this: Select from the potatoes proposed for seed a dozen or

two; cut them with a sharp knife into sets; then put them on the floor of a potato-house, or any other place free of damp, with the skin next the floor; if, upon examining them three or four days after, it will be found that the incision has dried up, and be covered with a kind of new skin, be assured that the seed is wholesome—plant it; but if, on the contrary, the wound is found to be wet, sluggish, and spotted—touch not the unclean thing, but be certain that the constitution of the potato is exhausted. This experiment should not be tried until vegetation has completely taken place, say about the middle of April."—p. 16.

We shall not accompany Mr Aitken into the comparative merits of cut and whole seed, the raising of early potatoes in the fields, or the method of raising new varieties from the seed to secure the renovation of the potato, all which subjects will amply repay perusal; but only intimate that the appendix contains the remarks of Mr Aitken on the papers on the potato failure which has appeared in the Highland Society's Transactions, and elsewhere. We say to all potato cultivators, "Read, mark, learn, and inwardly digest," Mr Aitken's little work, for your own sakes.

ACCOUNT OF THE INSECTS MOST INJURIOUS TO VEGETABLES AND ANIMALS, AND OF THE MEANS BEST CALCULATED TO COUNTERACT THEIR RAVAGES. NO. I.

By JAMES DUNCAN, M.W.S., &c.

Quæ et quantum *noceant insecta* exquirere adgressus sum, ut civium forte meorum aliique inde intelligant et discant, quantæ sit necessitatis ea rite noscere, tum ad Dei in nobis augendum timorem atque reverentiam, cui tam fortes tremendæque in promptu sunt copiæ, quibus sui apud nos oblivionem debellet; tum ad ea præcavenda incommoda, quæ nostræ alias negligentiæ jure meritoque tribuerentur.—*Linn. Amœn. Acad.* iii. p. 338.

WHEN it is considered that the number of insect species inhabiting Britain is between ten and eleven thousand, that the individuals constituting these species exceed in most cases all calculation, and that the proportion of about one-half subsists entirely on vegetable substances, it becomes obvious that the aggregate amount of damage they occasion to the latter must be very considerable. Many, it is true, derive their sustenance

from plants of no direct utility to man, while in other instances, where this is not the case, the injury committed is so slight as scarcely to deserve consideration; and although these deserve to be studied for the purpose of observing their structure, ways, and instincts—always curious and interesting subjects of inquiry—they do not call for attention in any other view. But the case is very different with such as attack the plants to which we are chiefly indebted for our food, or which form the principal support of our domestic animals. The extent to which this takes place is unhappily a matter of daily observation. There is scarcely one of our most useful plants which is not assailed in one way or other; and the forms of insects and their modes of living are so infinitely diversified, as to enable them to continue their depredations in all the different states of these plants. The various kinds of corn, for example, have a host of enemies in the subterraneous larvæ of beetles, which consume the roots; various kinds of caterpillars feed on the blade; some particular species attack the ear; and, even when laid up in apparent security, a small beetle is often found to scoop out the interior of each grain, and convert it into an abode for itself. The turnip, in like manner, is equally exposed to these depredators. If the seed of this useful plant escape the attack of a minute weevil, another enemy awaits the unfolding of the cotyledon leaves, and a third buries itself in the bulb and rootlets, which become diseased and covered with unseemly excrescences; while the mature foliage is often consumed by caterpillars, as was exemplified to a considerable extent last summer. Many plants have a particular insect appropriated to them; others, as in the examples mentioned, form the food of several different kinds; and when it happens, from some mysterious cause which we are at present unable to penetrate, that these creatures suddenly increase beyond their due proportion, the partial or entire destruction of some of our most valuable crops is occasionally effected by their agency.

But even when there is no remarkable augmentation of their numbers, there is reason to believe that the injury occasioned to vegetation by insects is at all times greater than is generally supposed. Their operations are often carried on under cover, either beneath the surface of the soil, within the substance of the plant,

or in other situations where they escape observation. Many kinds, again, feed only in the night, and conceal themselves during the day in holes and crevices. In consequence of this latent and insidious mode of attack, there is no doubt that we are often led to ascribe the unhealthiness and decay of plants to badness of soil, unfavourable weather, and other causes, when in reality they are produced entirely by insects. The attention of gardeners and agriculturists, moreover, is seldom directed to their depredations, unless when these become so extensive as to threaten serious injury to their crops; but it is obvious that they must be carried on to a greater or less extent every season, for the existence, at least, of the respective species is always maintained, and this can only take place at the expense of the plants on which they are destined to feed. Whether, therefore, they fall under our observation or not, there is always a host of minute depredators at work, which, in the instinctive prosecution of their own habits and economy, interfere in no inconsiderable degree with the interests of the agriculturist, by preventing the full return which many of his crops would otherwise produce.

In these circumstances it becomes a matter of some importance to inquire into the means which seem best calculated to secure our useful vegetables against the injuries arising from this cause. It may be affirmed that very few efficient remedies have hitherto been discovered; and it generally happens, when noxious insects appear in unusual profusion, that they must either be allowed to ravage our crops unmolested, or if they can be checked at all, it is at a trouble and expense disproportionate to the advantage sought. The only course which is likely to lead to the discovery of proper remedies, is to investigate carefully the habits and natural history of the respective species of insects, in connection with the structure and general physiology of the plants which they attack. In prosecuting this object, the attention should be directed to ascertain the time when, and the manner in which, the eggs are deposited, as well as their composition, and the consistency of the enclosing membrane, with a view to determine in what way the vital principle might be most easily destroyed; for there seems reason to believe that this may occasionally be effected simply by sprinkling them with

some kind of medicated liquid, a remedy which would possess the advantage of being easily applied over a great extent of surface. The habits of the larvæ call for particular attention, as it is generally in this state that the mischief is committed: the period of their appearance—their times of feeding—plants on which they feed, and (if attached to more than one) the kind they seem to prefer—the part of the plant attacked—duration of the larva state, &c. should be carefully noted. An acquaintance with the places to which the larvæ usually retreat when about to change to pupæ, and with the structure, duration, &c. of the latter, might probably suggest some easy means of destroying many in that dormant state. A knowledge of the economy of the perfect insect is, of course, of the utmost importance; if we could become acquainted with the retreats in which they pass the winter, or find means to destroy the few that generally survive when they first appear in the spring, and before they have deposited their eggs, the injuries which are sustained by their means might be altogether prevented.

The progress which the study of entomology has made of late years in this country, enables such investigations to be carried on more easily, and with greater probability of arriving at some successful result, than was the case formerly. The nomenclature and arrangement of this branch of Natural History has been, in a considerable degree, settled, and in general no great difficulty is experienced in assigning its proper place in the system to any given species. By this we have it in our power to determine its name, and to learn all that is previously known of its history; and are thus enabled to give a proper direction to our inquiries, and prosecute them on more scientific principles. It must be admitted, however, that more progress has recently been made in naming and classifying our native insects, than in illustrating their habits and general economy. The latter requires opportunities as well as powers of observation, not granted to every one who may yet be of some benefit to the science, by collecting specimens and recording their localities. But it is to be hoped that this department of the subject, highly important as it is, will not continue to engross the attention of naturalists, almost to the exclusion of inquiries from which much practical benefit may be expected to flow. It is no ex-

aggeration to affirm that we are unacquainted with the modes of living, metamorphoses and general history of forty out of every fifty species, which have been named and minutely described in their perfect forms. A striking proof how much this department has been neglected in this country is afforded by the fact, that the principal sources of information are still to be found in foreign works, and these of so remote a date as the middle of the last century.*

With the hope of drawing some attention to this subject, and contributing something to its elucidation, we have thought that it would be useful to give an account of the insects which have hitherto proved most hurtful to vegetation, as far as we have been able to ascertain their history. The notices at various times published regarding them are so scattered and insulated, that it may be of benefit to collect the most important particulars into one view, accompanied with descriptions of the insects in their different states, and such suggestions for guarding against their attacks, as either the most recent and approved works on the subject, or our own observations, may enable us to supply. An acquaintance with what has been already done will best shew what is still wanting; and enable future observers to give that direction to their inquiries which is most likely to lead to useful results.

All the great primary sections, or *Orders* as they are called, into which insects are divided in systematic arrangements, contain a greater or less number of such kinds as fall within the scope of the present notice. As one of the most extensive and important of these divisions, and containing a considerable number of species which injure cultivated plants, we shall first refer to the Coleoptera, or Beetles, which are readily distinguished by having their wings covered and protected by a hard horny crust or shell. It is for the most part in the larva state that these insects are most hurtful, and it is in this state that they are named grubs, a term often very vaguely applied, but which ought to be restricted to the larvæ of beetles. These are in far the greatest number of instances subterranean, and consequently the injury they occasion is by consuming the roots. They are usually of an elongated depressed form, and uniform

* The works of Reaumur, De Geer, &c. are alluded to.

pale colour, exhibiting none of that depth and variety of tint, observable in those which live on the foliage of plants, and exposed to the influence of light. In their general forms and structure of their parts, they, of course, vary greatly according to the different tribes to which they belong. We shall first advert to the kinds which have been named

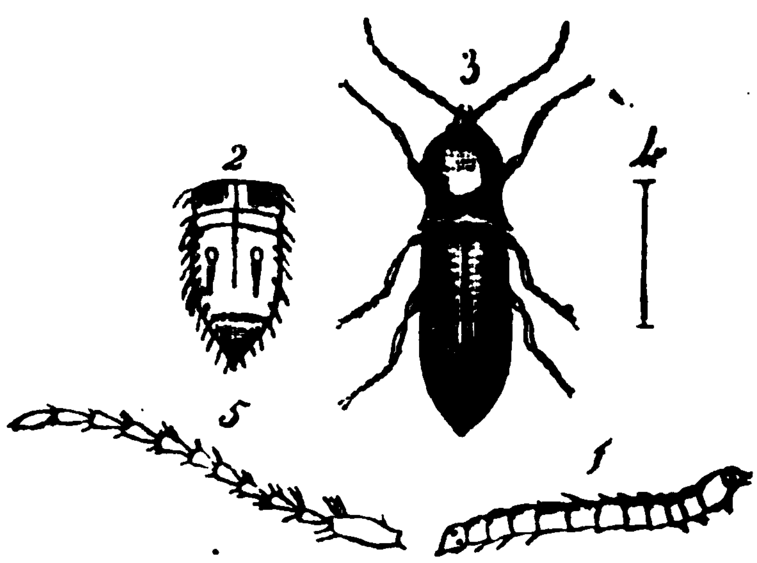
WIRE-WORMS.

These have a long, slender, and cylindrical body, covered by a hard tough crust, which has occasioned the above name. They are composed of twelve segments, fitting closely to each other, and are provided with six conical scaly feet placed in pairs on the three segments next the head. The latter is furnished with short antennæ, palpi, and two strong mandibles or jaws. They are the larvæ of that tribe of insects named Elateridæ, or click-beetles, which are readily known by having the sternum produced behind into a strong spine fitted to enter a groove in the abdomen situated between the intermediate pair of legs. By bringing these parts suddenly into contact, the insects are enabled to spring to some height into the air, and thus recover their natural position, when they happen to fall on their backs, which they frequently do when dropping from plants to the ground. A special provision of this kind is rendered necessary in consequence of the shortness and weakness of their legs.

Upwards of sixty different species of these insects occur in Britain, and it is probable that a considerable proportion of them feed upon our most valuable cultivated plants. The same species of larva does not appear to confine itself to one kind of food, but attacks indiscriminately the roots of corn and other grasses, as well as esculent roots, such as turnips, carrots, radishes, &c. But it is at the same time deserving of notice, that as a strong similarity prevails among larvæ specifically distinct, it is probable that different kinds may often have been confounded, and a more correct knowledge may prove them to be more restricted in their choice of food than is at present supposed: this at least is rendered not unlikely by what is observed in analogous cases. We are as yet acquainted with the metamorphoses and habits of a very small number of these insects; and it is therefore highly desirable that whenever a destructive wire-worm prevails, it should be traced to the perfect

condition. This, however, is attended with considerable difficulty, owing to the length of time they continue in the larva state, extending in many instances to several years. But we are fortunately enabled to furnish a pretty complete account of one of the most common kinds; and as the family is a very natural one, we may thence derive a pretty correct notion of the natural history of the whole. Any mode of treatment which checks the depredations of this species, will probably be equally effectual in regard to the others.

The species alluded to is the larva of *Cataphagus lineatus*. When full grown it is about seven lines long, and rather less than a line in breadth, (fig. 1.) The shape of the body would



be perfectly cylindrical were the back not a little depressed. It is entirely of an ochre-yellow colour, except the anterior part of the head which is brown; for some time after a change of skin it is white. Owing to the rigid consistency of the skin or crust, the larva can scarcely contract its body, but as it is composed of rings or segments, it is flexible enough from side to side. These rings are twelve in number, the three nearest the head each provided with a pair of conical legs, and the caudal segment having a fleshy tubercle beneath which serves the purpose of a seventh foot. The last named segment is conical terminating in a point, and is remarkable for having two circular holes like two brown points on the surface, (fig. 2.) It is difficult to conjecture the use of these, unless they be a kind of stigmata which serve for respiration; but the real stigmata are placed along each side, appearing like small brown points from the fourth to the eleventh segment inclusively. The whole body is smooth, with a few scattered hairs.

The pupa into which this larva changes is nearly white with two black points over the eyes; the length about three lines. The front has two brown projecting points, and the abdomen consists of ten rings, the last of which terminates in two short spines.

The perfect insect which issues from this pupa (fig. 3.) is of a brown colour, thickly covered with short pubescence. The antennæ are about the length of the head and thorax, with the radical joint long and thick, the remainder obconic and equal, except the second and third which are rather shortest, and the terminal one which is longest; (fig. 5.) the colour obscure yellow. head retracted: thorax widely emarginate in front, rounded on the sides and having a narrow elevated margin, the hinder angles prominent and acute, the anterior margin and hinder angles usually rust red, the disk very convex and punctured. The elytra are light yellowish-brown, with rows of punctures which approximate in pairs, and the narrow interstices are of a darker colour than the rest of the surface, which has caused the name *lineatus* to be applied to the insect. The under side of the body is dusky and pubescent; the legs obscure yellow: length about 4 lines, breadth 1¼; (fig. 4. line shewing the natural length.)

This insect occurs in considerable plenty throughout the country in grass fields and pasture lands, and is usually found creeping among the herbage, or lying at the sides of stones; it is scarcely ever observed on the wing. Another species (at least what is usually regarded as such) occurs in similar places and generally in much greater abundance, at least in Scotland, viz. *Cataphagus obscurus*. This insect is so closely allied to that above described, that it may be readily taken for a variety of it, and there is little doubt that the description of the larva of *C. lineatus*, will apply almost equally well to that of *C. obscurus*. From the great abundance of the latter, it may be presumed to be the species which commits most injury in this country.*

* There is another species which occurs even more plentifully in ploughed lands throughout the south of Scotland, but which we have never heard charged with similar depredations. Yet there is no doubt that the larva is a root-worm, and from the places which the perfect insect frequents, it is likely to feed on the cereal and other useful grasses. This is the *Hypnoidus riparius*, a small insect of a brassy-black colour, with pale reddish legs.

RETROSPECT OF THE BRITISH AND FOREIGN CORN TRADE DURING THE HALF YEAR ENDING MAY 1837.

By Mr W. Gray Fearnside, London.

In commencing a review of the state of the grain-trade, the subject of the weather is too important a topic to omit noticing in detail, as the variations in the barometer have frequently a controlling influence on the currencies and character of the markets. During the close of November and beginning of December, a considerable fall of rain was experienced, which materially impeded agricultural operations, the saturation of the earth preventing farmers from making much progress in getting their seed into the ground, while the completion of potato digging was deferred to a very late period; on the 23d the wind veered to the north-east, and all the characteristics of Old English Christmas prevailed, snow falling in such quantities that the metropolis was rendered almost isolated, being cut off from all home and foreign communications. Throughout the course of January the weather was gloomy in the extreme, depressing the animal, and consequently the speculative, spirits to the very lowest degree. The land remained wet and too cold to work, a great portion of winter wheat being unsown, and, in low situations, the land so soft and swampy, that it was rendered totally unfit for preparation to receive the spring corn. In many parts of England during this month as well as February, particularly northward, as well as in Scotland and Ireland, field labour was nearly suspended, most of the land intended to be sown with wheat still remaining in fallow; little progress made with spring sowing, and the growing crops deluged with rain, with partial sunshine by day, and hoar-frost at night. During March the weather set in cold and frosty, accompanied with drying winds from the east and north-east; and in some localities in England, the thermometer was five degrees lower than during any other period of the winter. The low lands were consequently brought into excellent condition; and in Ireland, few seasons have occurred in which the ground has become more mellowed and friable, or in finer condition to receive the seed; and though the nights were cold, which checked vegetation, yet great advances were made in all spring sowing, and the young wheats, in those counties on which London is more dependent for supply, assumed a more healthy and vigorous appearance, and, though backward, began to tiller out well. Scarcity of fodder, however, which had continued to prevail, had now become extremely severe, and, in some instances, hardly procurable; and considerable quantities of barley and oats were taken as substitutes for feeding sheep and cattle. In Scotland, the dearth was experienced to a greater extent, and which, in union with the severity of the weather, caused severe losses to graziers and owners of sheep, especially during the lambing season, which happened in the more mountainous districts while the snow was on the ground. Up to April, a similarity of weather and incidental circumstances was prevalent throughout the United Kingdom, with the exception that in Scotland, vegetation was more retarded and field operations more in arrear

than in most parts of England and Ireland. Indeed, from the commencement of the present year, month has succeeded month, and as later drew the period when, in the usual course of the seasons, Nature evinces the advancement to a more kindly and genial temperature, when weeks began to be numbered to the advent of the summer solstice, the hopes and fears of the farmers became intensely excited; and until the near approach of May, few gleams of sunshine had appeared to cheer their prospects, nor had Nature's powerful agents, heat and moisture, been apparently in operation to promote the necessary advances of the vegetable kingdom. The apprehensions, however, entertained by the growers were chiefly founded on the aspect of the fields compared with similar periods of later seasons: and it is true that conclusions thus momentarily deduced could not, from existing appearances, have been then attended with any very favourable results. But the current year, from its peculiarly unseasonable character, has formed no fair criterion for judgment, and causes and their effects must have a more extended range for substantiating an opinion than the few past prolific and favoured seasons, though commonly it is with those representatives most fresh in the "mind's eye" that comparison is formed; the recollection is impressed that at a similar period in the last five years, the young wheats had spread out their curling blades, and the land covered with a rich bed of deep luxuriant green, but that, in April last, the eye had to wander over fields almost bare of verdure; forgetting, however, that we had no reason for imagining that the root of the wheat plant was affected, or that the germ of vitality was destroyed, but that with a return of mild temperature and genial showers, such as we are now experiencing, the vegetative though latent powers of the plant were ready to burst forth with redoubled vigour, and which we have had the gratification of lately witnessing—the whole aspect of nature having started into life with all the magic rapidity of a Russian spring. Had any sudden and severe check been sustained, had all the vitality of the wheat plant been ready to burst forth into being, and the circulation of the juices had become paralyzed by an unexpected atmospheric transition from summer's warmth to winter's cold,—then might we be fearful of the future consequences, instead of which the weather, even previous to the germination of the winter corn, has been chilly and ungenial, not at any one time having afforded a stimulus to growth; and, therefore, with seasonable weather, we may with confidence expect that the dreary apprehensions entertained for the fate of the harvest will be effectually remedied, and which the young wheat is exemplifying, by having so quickly assumed an improved and healthy aspect, though, in places, the plant still appears thin on the ground; and the breadth sown, owing to the obstructions the sowing of winter and Talavera qualities has had to encounter, has been much less than was contemplated, and which the advanced price of the article would have naturally induced. In England it is calculated not to exceed a customary average, but much less than usual in Scotland, and though increased in Ireland compared with the past season, yet still below an average of the augmented ratio of the few preceding years; in some instances in the latter kingdom, the cultivation of flax has been partially superseded by wheat, and is likely the current year to be discontinued to a considerable extent; many causes having combined to deter the farmer from sowing in larger

quantities than may be necessary for the employment of his own family. The additional expense for seed, the labour in preparing the ground, the number of hands requisite for weeding, pulling, watering, and grassing; the uncertainty of this process, the success of which depends so much upon the state of the weather and quality of the water, and in which a slight error may ruin the best crop; supposing all these to have been judiciously managed, the still greater risk of *scutching* being *skilfully* and *honestly* performed; but if, by great good fortune, the owner has been hitherto favoured in these respects, still the fineness of the texture must determine the question of a renumerating price. When we add to all this, that, from the closeness of the stems, the crop brings no manure, and leaves no stubble, the ground being more exhausted by the growth of flax, than, perhaps, by any other crop for the length of its continuance in it; indeed, unless clover or a potato crop intervene, good wheat, oats, or barley, need scarcely be expected. But in order to induce farmers to cultivate flax on an extensive scale, encouragement should be held out by liberal landlords and Farming Societies; and surely it would be a prudent policy in those possessing large spinning establishments to give as much preference as possible to the home growth; while owners of scutch-mills who are prevented from superintending their own concerns, should secure overseers and labourers of approved *sobriety*, *experience* and *honesty*; and thus give a confidence to the farmer, without which he can scarce be expected to risk the hazards of an uncertain crop. One of the most successful modes of rearing flax, and which, in fitting soils, has seldom failed, is, to lay out the ground in ridges of not more than ten feet wide, giving an additional ploughing, plough trenching the *hintings* pretty deep, and finishing the operation of harrowing by cross strokes, which will fill the furrows; roll well up and down, then sow your seed and cover it neatly with shovels, out of the furrows. Flax sown in this way comes up beautifully regular, none of the seed being too deeply buried, and none left uncovered; and thus spouting simultaneously, it will ripen together without the usual quantity of after-growth.

The sowing of summer corn has been eventually brought to a conclusion, and after all the ordeals it has had to encounter, has terminated throughout England, Scotland, and Ireland, under favourable auspices, and in parts four to five weeks earlier than last year; but, at the same time, it must not be lost sight of, that the advanced period of the season at which most of the seed in the more northern districts, was committed to the ground, renders the future condition and quality of the crops more precarious in a climate liable, at the autumnal equinox, to such sudden vicissitudes, and much irregularity of growth and ripening is likely to prevail.

We may be allowed to take some credit to ourselves for predicating last November, when a species of speculative *mania* pervaded the trade, when the excitement of one market infested another, which, as it were, inflamed again the one from whence the existing cause originated, until speculators became alarmed at their own creations. It is now apparent, as we then intimated, that the speculations emanated from want of quality and momentary supply, and more facility having been afforded in procuring discounts, and not from circumstances founded on facts or actual emergency; ridiculing the idea, that was entertained by sanguine purchasers, that England, France, and America,

have to wage a war, not of opinion, principle, or aggression, but that
ntest would be fought on the shores of the Baltic, Elbe, and Black Sea,
privilege of obtaining bread-corn. From this memorable period in the
n annals of the Corn Trade, prices have, with slight fluctuations, con-
l to recede, and those holders acted wisely, who realized on the excite-
of the moment; having obtained rates not likely again to range, unless
tous circumstances should attend the growth or securing of the ensu-
ops. During the close of November and first week of December, Essex,
sh, and Suffolk, white wheats were noted at 66/ to 68/, 70/ and 72/; red
58/ to 60/, 63/ and 64/; exhibiting a reduction of 4/ to 6/ in the top quo-
s as compared with the commencement of the month of November;
in May, red wheat of similar quality was noted at 52/ to 55/; white 56/
', shewing a decline in the extreme currencies, between the two periods,
on red and 12/ to 14/ on white qualities; manifesting that the specula-
was principally on quality and condition, fine old white wheats having
a higher relative value, when the samples brought to market were gene-
handling cold and damp. During the intermediate months, however,
have been strong operating causes which have contributed to depress
urrencies considerably lower, then they might reasonably have been
:ted to have ranged, when the inclemency of the season is con-
ed, and the doubtful state in which vegetation remained; this "pres-
from without" was caused by the unprecedented condition of the
y market, and the total disorganisation which the proceedings of the
of England have created in monetary engagements,—mercantile
dence having been shaken to its very foundation; and though farmers
been latterly generally holding back supplies in expectation of enhanced
, and which the high prices obtained previously for grain and stock have
led them more readily to accomplish; yet we have not ceased to point
o them that little hope could by possibility be entertained in the reaction
ain or of any other commodity. In all convulsions of the monetary sys-
it follows as a sequence, that purchases and sales are regulated by the
ssities of individuals, and not by any generally recognised standard of value,
ordinary times; consequently the prices of those articles whose
umption is pressing on the power of production, recede the slowest in va-
but where the reverse is the case, articles are precipitated even below
cost of production. During, therefore, this transitory stage in the value
mmodities, no miller or merchant, purchasing beyond the amount neces-
for the supply of immediate wants, the disengaged capital accumulated
ly in proportion to the increase of commercial difficulties, and became, as
been latterly exemplified, concentrated in the metropolis and larger towns,
ad of being diffused over the provinces for the support of industry. As,
efore, it is evident that the vent for grain and all articles has been
ly measured by the actual consumption, it is equally evident that,
er the contingencies which have occurred, it was highly impro-
e that the value of grain could be enhanced; but, as ranking among
e articles before alluded to, whose consumption was pressing on
ply, it continued to bear a high relative price compared with other
modities, though certain ultimately of sharing in the general depression—

a depression which, calculating together the profits of manufacturers and wages of the operatives, has exceeded 30 per cent. on most other commodities. Unless, therefore, positive scarcity was experienced, or the growing crops ascertained to be decidedly injured, no reaction in the markets could, on reflection, have been anticipated; though, at the same time, as the stocks of wheat have been considerably diminished in all the principal corn depots of the kingdom, prices must be necessarily more dependent on the above exceptions, as well as on the speculative inclinations and capability of growers to retain their stocks. It is also to be observed, that though there are perhaps throughout the country less wheat ricks than usual at this period of the season, yet it is known that farmers in districts of England hold a large quantity of this grain in chaff, having thrashed out freely from the want of straw for cattle; while in parts of Essex, Kent, Norfolk, and Suffolk, and in portions of Yorkshire, the yield of the last year's crop of wheat on being relieved from the straw exceeds anticipation, and leads to the belief that it will prove fully adequate to meet the deficiencies of less favoured districts, especially in Scotland and Ireland.

Annexed is a septennial account of the supplies of wheat and flour into the port of London, from England, Scotland, and Ireland, from the Michaelmas of one year to the 1st May succeeding.

	ENGLISH.		SCOTCH.		IRISH.		TOTALS.	
Michs. 1st May	Wheat. Qrs.	Flour. Sacks.	Wheat. Qrs.	Flour. Sacks.	Wheat. Qrs	Flour. Sacks.	Wheat. Qrs.	Flour. Sacks.
1830–1831	100,030	223,849	3,690	1136	72	8,294	103,801	233,279
1831–1832	136,195	246,496	47,347	2195	76,839	61,003	260,381	309,694
1832–1833	179,128	222,234	5,269	1373	20,890	22,031	205,287	245,638
1833–1834	194,803	235,308	7,542	1241	13,355	17,609	215,700	254,248
1834–1835	246,440	239,071	8,972	1577	4,530	5,031	259,942	245,679
1835–1836	255,414	258,277	1,315	1936	1,065	1,019	257,794	261,232
1836–1837	205,147	263,849	285	1972	5	2,077	054,372	268,498

The supplies of barley have continued liberal during the half-year, and the result of the trade has generally disappointed speculators and holders, an event which frequently occurs, when prices set in high, at an early period of the season. The markets, in order to be kept up in price, are only supplied by the grower to the presumed extent necessary for the immediate wants, and, when a relaxation of demand ensues, with large stocks on hand, and several thousand quarters of the foreign article pressing on the market at a low duty, a considerable depreciation must be the consequence. The principal cause which has operated unfavourably on the trade has been the constant heaviness of malt, and the difficulty maltsters have experienced in quitting the article, arising from the unusually large quantity of old malt in possession of the principal dealers, at the commencement of the past season, and which has materially circumscribed the customary demand for the new samples; not that any considerable diminution in the consumption of malt is to be implied, as the surplus of the previous year added to the present will strike an aver-

age for the two seasons, though the London brewers latterly have complained of a falling off in the demand for beer, which has in part emanated from the prevailing epidemic, partly in the reduction of wages and labour, and improved system of withholding out-door relief to the poor—a source also of considerable loss to the spirit-retailers, and it is almost incredible the consequent decrease which has occurred in their weekly sales, owing to this one fact; as in the poorer districts of the metropolis the greatest portion of the parochial relief, which should have been dispensed in support of the family, was wasted in procuring the deleterious beverage of *Gin*. This desideratum alone, wrought by the new poor-law bill, in counteracting the demoralization of the lower classes, from the use of this pernicious spirit, speaks volumes laudatory of the principle of the act. During the late inclement weather, however, rather an excess occurred in the drinking of spirits, and a diminution in that of malt liquor.

We noticed in our last retrospect, that considerable orders have been sent abroad for the purchase of foreign barley, owing to the high range of the home growth, and the reported scarcity of the better qualities. During the whole of December, the aggregate averages ranging from 38/ to 38/6 per qr.; the duties receded to 4s. 10d.; and the stocks in bond were entered for consumption; and though the duties gradually advanced from the first week in the present year, yet the fresh parcels as they arrived from the Elbe and Baltic paid the prevailing duties,—the principal portion 9/4, and a few later cargoes 13/10 per qr. The total amount which has paid duty in the kingdom since November has been 118,032 qrs. The speculation has, however, been unprofitable, and even the cargoes admitted at 4/10 left little profit, the prices having risen with the demand abroad, and since then, with an increased rate of duty and a depressed currency when brought upon the market. The loss has been serious; in November and December the range of prices in Mecklenburg, Holstein, and Denmark, were from 19/ to 21/, and extra fine 22/; but the demand for Norway, which succeeded that for English account, has prevented prices from materially receding. The currencies being now quoted, 17/ to 18/. At Hamburg, the earlier sales of Bohemian and Saale barley were made at 26/6 to 28/6 per qr., declining to 25/ and 24/, and, latterly, to 18/ and 17/6 per qr. The quotations of the home growth have been subjected to almost a monthly decline of 1/ to 2/ per qr.; at the close of November, chevalier barley of the finer qualities was noted at from 40/ to 42/ and 44/; Norfolk and Suffolk 36/ to 38/ and 39/; Grinding 30/ to 35/; Foreign fine 35/ to 38/; inferior 30/ to 33/; exhibiting a decline compared with the present prices, of about 6/ to 7/ per qr. Malt, from the causes assigned, has receded about 6/ per qr. on the finer samples, and 7/ to 9/ on brown qualities. The stocks of barley in those counties on which London is principally dependent, is still represented as large, notwithstanding the extensive additional consumption of the article for feeding cattle.

Considerable fluctuations have been experienced in the oat-market, being an article of constant and extensive demand in the metropolis, the sales in Mark Lane averaging 20,000 qrs. weekly; yet incidental circumstances have conduced to a depression in the prices, which could not have been taken into

the verge of calculation, nor would they have occurred had the transactions in the article been conducted fairly and honestly in Ireland, and which we will take occasion here to illustrate. We have ever deprecated the system which has of late years been adopted, in selling Irish oats free on board at stipulated prices for forward delivery; these speculative contracts being formed before the crop is secured, and extending five, six, and even eight months in advance. Parties who had sold, during the latter months of the last season, for forward delivery at lower rates than those to which prices afterwards advanced in the London market, resorted to the expedient of shipping, not only light inferior quality, apparently, in instances, the refuse of the markets, having, in many cases, not been at the expense of kiln-drying them, or at all events, very insufficiently; thus completing their contracts as to quantity, and saving themselves from loss for non-fulfilment, and attempting, if possible, to acquire a little profit, even out of a bad bargain; trusting to the future casualties of time and law, as to the point of quantity and condition of the sample. The consequence has been, the cargoes on arrival proved totally unsaleable, and where a possibility existed to save the expenses of landing, were forced off at 14/ to 17/ per qr. Where advances had been previously made on the consignments on faith of the shippers, serious deficiencies have been sustained, and in *bona fide* purchases on contract, the loss has been also great; so material was the disparity between the *stipulations* and realizations. The courts of law may be said to be open for the punishment of such chicanery, but in too many cases it was feared, the attempt "at cure would have been worse than the disease;" exemplifying the adage *ex nihilo nihil fit.* And we must briefly, in conclusion of these remarks, add, that the selling a quantity of grain at a fixed price before it is cleared off the field, the one party trusting to *chance* to procure it, having, perhaps, *everything* to gain and *nothing* to lose; the other, taking the *chance* of the fluctuations of the trade, is forestalling the market, and not a *legitimate* mode of transacting business; it is no longer a *bona fide* transaction, but a time bargain, and owes its origin to the questionable source and principles of the Stock Exchange. The late results may, however, be attended with salutary effects in checking those speculative calls, those gambling transactions, which are highly injurious and inimical to the general principles of fair and honourable commerce.

The trade in oats, towards the close of the year, ruled dull, and the high rates of 14/ to 15/6 per barrel, demanded in Ireland, prevented free unbounded sales. Prices during the first three weeks of December receded 2/ to 3/ per quarter; but, at the termination of the month, frost having set in and the cold weather always proving an incentive to an increased consumption, the market rallied for good sound corn, the bulk of the samples being weathered, out of condition, and inferior; quotations advanced 1/ to 1/6 per quarter. In January, however, it being ascertained that the duties on the admission of foreign qualities, which, during the previous month, had remained at 7/9, was the minimum range then likely to be attained, holders of bonded parcels paid the dues on a portion of their stocks, expecting that, towards summer, the averages would advance, and a more favourable opportunity be afforded them of entering the article. A few thousand quarters more, however, paid the duty of 9/3; the whole amount paying

duty being 95839 quarters. This quantity being brought on the market, and a change of weather ensuing, rendered the trade extremely heavy, with an extra pressure on it, owing to the quantity of stale inferior parcels remaining a drug on the market, being scarcely saleable at prices even below their relative value; and fresh Danish, Friesland, and Dutch qualities commanded a preference. The consecutive months' prices generally tended towards a decline, and speculation remaining inactive, until latterly, the scarcity of all descriptions of fodder has created an entire country demand for the article for feed; but the influx of supplies from the oat granary of Britain and Ireland, prevented any decided improvement in the trade; though a feeling is now prevalent, that prices have seen their lowest range, and the stocks for the period of the year being generally reported light in England and Scotland, we are rendered almost totally dependent on the resources of Ireland; a firmer tone is likely, therefore, to be maintained, and an advance rather than a decline to be anticipated. Scotch oats, which, on their first appearance at market were out of condition, and the samples exhibiting that the grain had been much exposed to the weather, improved on the appearance of the frost and cold, but having borne a higher relative value in the places of production than could be obtained at the London market, the supplies have been extremely limited, and the quotations more steadily supported than any other descriptions. Bonded oats have monthly met a partial demand for export, principally to the West Indies, at from 14/ to 15/6; for feed and brew qualities 17/ to 20/ extra fine. Friesland 21/ to 22/.

The following currencies at the two periods of our report, will exhibit the depreciation which has taken place in the article.

1836, Nov.	English feed	25/ to 30/	Potato and Polands	28/ to 32/
1837, May,	do.	22/—26/	do.	26/6—28/
1836, Nov.	Scotch common and Angus,	28/—30/	Potato	31/—33/
1837, May,	do.	23/—26/	do.	27/—30/
1836, Nov.	Irish feed,	25/—27/	Potato 27/—30/ Black	26/—28/
1837, May,	do.	18/—23/	do. 22/—26/ do.	18/—23/

The subjoined account may prove interesting, as exhibiting at one view the quantity of British oats which have arrived in London during the last seven years, together with the annual quantity of foreign which have paid duty for consumption at the port, the gross total furnishing the amount required to meet the demand of Mark Lane.

Years.	English qrs.	Scotch qrs.	Irish qrs.	Total qrs.	Foreign paying Duty in London, qrs.	Gross total qrs.
1830	186,265	139,446	276,670	602,381	493,467	1,095,848
1831	269,148	144,631	332,099	745,808	266,713	1,012,561
1832	207,944	117,883	681,957	1,007,784	131	1,007,915
1833	203,207	176,979	573,349	953,533	671	954,204
1834	163,671	326,402	488,822	978,895	46,771	1,025,666
1835	101,641	217,049	721,494	1,040,184	125,575	1,165,759
1836	206,006	169,239	616,560	991,805	45,612	1,037,417

Giving a septennial average of 1,042,767 quarters, and a weekly consumption of 20,053 quarters.

The high prices maintained for beans and pease at the close of November, operated on the averages to an extent to admit foreign qualities during December at nearly the lowest range of duties; beans being admissible at 2/, and pease 3/6 per qr., the foreign parcels in consequence pressing on the market, rendered the trade throughout the month of January heavy and declining; old beans, which were worth 48/ to 52/, receding to 42/ and 48/, and white pease, being reduced in value from 42/ and 46/ to 38/ and 40/: during February, the inferior condition of the new beans checked their sale, and pease also were difficult of disposal, and prices weekly gave way, but during the succeeding months, the demand for both articles improved; the quantity of foreign having been worked off, and the condition much improved by the cold weather, the continuance of which causing an increased consumption, especially of pease, and the receipt of orders for shipment to Scotland, particularly of blue qualities, with some speculative exports to the north, materially influenced the markets; and prices rallied, the currencies continuing speedily to advance, since which they have again slightly receded, beans being now quoted at 40/ to 42/, and pease 38/ to 40/,—and as the stocks are short throughout the kingdom, any material fluctuation is not to be expected, until the crops are sufficiently advanced to give some ground for forming an opinion of the future yield. The early podding pease have suffered considerable injury from the protracted cold weather. With reference to the foreign qualities it may be remarked, that beans abroad have not receded to the lowest point of last year by about 20 per cent.; and, though purchases may turn out a good speculation, yet they cannot be considered a safe investment at the present rates; while pease may be procured at several of the Baltic ports at 18/ to 20/ per qr., prices which afford much more margin than that of beans, especially when we consider the general clearance which has been effected of the winter importations, and consequently the probable scarcity which is likely to ensue before the next crop can appear at market. Since November the amount of beans which have paid duty in the United Kingdom have been 68,788 qrs., and of pease, 42,120 qrs.

In reference respectively to Scotland and Ireland, little novelty of remark arises in addition to the observations already offered relative to England, the same weather having prevailed; but in the more northern districts of the kingdoms, the cold has been experienced with more intensity, and consequently the field operations more retarded. One unfortunate fact, however, requires particular allusion,—the privation and misery prevailing in the Highlands and Islands of Scotland, occasioned by a failure in the crops and fisheries, and the consequent dearth of interchangeable commodities to afford the means of obtaining the necessaries of life. Our sympathies have been considerably excited, and our feelings powerfully appealed to in attempting ephemeral means of preserving the sufferers from starvation.

The demand for oatmeal at the principal northern ports of Scotland, and a speculative feeling being entertained by the farmers, that the stocks of oats are not equivalent to the demand until the new crop is fit for consumption, have induced them to keep the markets scantily supplied, and prices continue to rule too high to tempt shipments to English ports. The inferiority of the wheats this season has created an early demand on our eastern coast for the shipments of the finer qualities, and the top range of currencies at Edinburgh

has been throughout more steadily maintained than in London, and is now much higher than the extreme prices of the best Essex and Kentish samples, and though it is known that further supplies will be required from our market, yet we do not apprehend any enhancement in the value of the article in England on account of scarcity. Considerable losses have been sustained among the sheep and cattle owing to the severity of the weather, but the rapid communication by steam between the two kingdoms, and the large quantities of cattle shipped to our shores, which have been realizing high prices, may in part counterbalance the loss.

In Ireland, speculation has been rife amongst the growers and merchants in the finer qualities of wheats, and in those of oats generally. Prices of wheat, from the same exciting causes which prevailed last November in England, have been exorbitantly advanced; white wheat at Dublin having been noted at 43/ to 45/, and red 40/ to 42/ per barrel, which, calculating the wheat to weigh 61 lb. per qr. was equal to 73/9 per qr. for the white, and 71/3 for the red; at present white being worth only 30/ to 32/6 per barrel, or 52/3 to 56/7 per qr., and red 28/ to 31/, or 48/9 to 54/ per qr. The increased consumption of the coarser kinds of flour, proceeding from a slow but happily gradual improvement in the internal condition of the country; and from the crop of wheat having proved deficient on the aggregate, the exports have been much diminished. Though the amount usually received into the London port does not afford any criterion as to the capabilities of the sister island to ship flour or wheat, yet at Liverpool it constitutes the bulk of the supply, and there the imports of British wheats and flour exhibit a very important diminution, having from September 1835 to May 1836 comprised 242,150 qrs. and 227,521 sacks, while for a similar period in 1836 and 1837, the arrivals consisted only of 110,751 qrs. and 163,676 sacks. The augmented consumption of barley in the distilleries and breweries, which latter is instanced in the extensive demand for "Guiness's Stout," prevents any export of the better qualities, and regulates the prices at a remunerating rate to the farmers. The export of oats to the London market for the year 1836 amounted to 605,222 qrs., being, with the exception of the years 1828, 1832, and 1835, the largest annual quantity ever received. Prices which in November ruled at from 13/ to 15/, fine heavy 16/ to 16/6 per barrel, receded 2/ to 2/6 per barrel during February and March, but again rallied, and are now ruling at within 1/ to 1/6 of the original rates.

In our retrospect for the similar period of last year, we drew particular attention to the establishment of the Agricultural Bank in Ireland, and the beneficial results attendant on the accommodation granted to farmers, enabling them to retain their stock, and to avail themselves of a favourable turn of the trade; a system which was laying the foundation of an important revolution in the whole of the agricultural population, but intimating that, if any check was experienced in the constant flow of accommodation, the reverse was likely to lead to considerable depression. The event remotely hinted at, has, we regret, occurred, and though the reaction has been much less severe than we had anticipated, owing to the confidence at the time that the payments would be eventually resumed, and which has fortunately followed, yet it had the temporary effect of depressing the trade, and forcing many of the smaller farmers to press their produce on the markets to meet their more immediate en-

gagements, throwing, at the same time, some degree of doubt upon the credit of the small occupiers of land, though, in the existing state of society in Ireland, it is to be rendered of incalculable benefit if judiciously applied.

Much interest is still experienced as to the currencies of grain, and many queries propounded as to their future tendency. The subject is one on which it is extremely difficult to offer an opinion at all likely to be coincided in, as it is liable to bias in the minds of speculators, holders, and venders to a considerable extent; the only attempt, therefore, that can be made, is to offer a range which might be reasonably expected, under a certain class of circumstances, avoiding extremes, and following the classic advice, "*in mediis tutissimus ibis*," recollecting that all arguments or opinions from statistical accounts, or grounded on former occurrences connected with the grain market, must, in a trade which assumes such *Proteus* shapes, set at defiance all the calculative powers of theory and practice as to the eventual results, more especially in a climate liable to such constant vicissitudes. Past experience proves, and in many instances too fatally, that where collateral circumstances have induced speculative enterprise, and seemed to combine in ensuring success, a sudden turn or event has occurred which rendered nugatory all theoretical speculation, however previously well defined. With a succession of favourable weather, and the combined powerful effects of heat and moisture, many holders may be induced to send their samples more freely to market, and a tendency may thus ensue towards a reduction of 1/ or 2/ in the prevailing currencies, which may be taken at 56/ to 58/ for the finer white, and 52/ to 55/ for red; sanguine speculators, on the other hand, are entertaining extravagant notions on the rates wheat will attain before another harvest. The farmers, however, who consult their ulterior interests, should be far from wishing a high range of currency, particularly if they entertain the belief that the present code of laws regarding grain is the most beneficial for their protection and interests. If extreme quotations are arrived at, and the duties consequently reduced, the market will be inundated with foreign wheat, and reaction take place more detrimental to their future condition than the temporary profits realized by the advance; at the same time, that so high a range of price should prove instrumental in favouring a revision of the Corn Laws, by the people demanding "with one fell swoop" a fixed or *ad valorem* duty, which would be determined at a lower standard than, under ordinary circumstances, the farmer might otherwise have confidently expected to have obtained. Since the period that greater facility has been afforded in procuring money, better speculative feeling has been evinced in the purchase of grain, manifesting, that with seasonable weather, no positive apprehension is entertained of dearth of supply before the new crop is secured. It is, however, to be hoped that the system adopted by America of averting the pending ruin of many of its most honest and wealthy citizens, whose property was not immediately convertible into money to meet the mercantile convulsion that was rending the whole fabric of international commerce, will have the permanent effect of reinstating confidence, and restoring that steadiness of character to the markets generally, which forms one of the vital principles of legitimate and wholesome trade, and will prevent the recurrence of the depression in grain emanating from the same causes which have already so powerfully influenced the transactions in

the corn markets of the kingdom. While adverting to this subject, we may be permitted momentarily to digress, in order to notice that a violent tirade is now opened against the Americans for the extent of their speculations, especially in the purchase of *new lands*. No doubt these land speculations have been carried on to an extravagant height, but it should be explained that the strong desire to obtain possession of the *fertile alluvial soil* of the Western States of America was superinduced by the higher rate of profit obtained on the cost of production, as compared with the *old settled* countries of Europe, or even of the Eastern States of America, and the speculations are neither more nor less than the exuberance of that desire. Neither can the Bank of England, by any effort or combination of the means it possesses, prevent investments being made in the securities of the public companies formed for the improvement of America, whilst they are enabled to pay on an average from a third to a half higher rate of interest than can be obtained in this country. In exact proportion, therefore, as it becomes difficult to invest capital profitably in the older States of Europe, this absorption of capital will be increased with accelerated force by every advance in locomotive power, altogether independent of the balance arising from the interchange of commodities between this country and the United States. It must further be borne in mind, that the American securities have a *more solid basis* than those belonging to the governments of Europe, as the American capital has, *without exception, been debited to improvements that will reproduce, whilst the European, and especially that of Great Britain, has been sunk unproductively in carrying on wars; and the tenure upon which the interest is held is a mortgage on the industry of the people, which can be only so long respected as the governments are enabled to coerce the payers. A low rate of interest is, indeed, the invariable concomitant of a high relative rate of taxation, and, if we have the blessing of the one, we must pay the penalty of the other, by the transfer of our surplus capital to countries where it can be rendered more productive*; these, though common axioms of political economy, are truths which ought to be widely disseminated, and duly revolved in considerate minds.

Annexed are the average prices of grain from the 1st of January to the last week in May of the current year, compared with the similar period of 1836, which exhibits a favourable result to the farmer, especially as connected with the principal commodity of life:—

	Wheat	Barley.	Oats.	Rye.	Beans.	Pease.
1837,	56.10	33.1	23.5	37.7	38.6	37.8
1836,	42.3	29.4	20.5	28.7	34.6	34.5
Improvement in 1837 compared with the corresponding period of last year.	14/7	3/9	3/	9/	4/	3/3

The foreign wheat trade, at least the corn markets at the principal ports of the Baltic and Elbe, have been hitherto wholly influenced by the casual demand experienced from the wheaten bread-consuming countries of Europe, among which Great Britain has hitherto maintained a controlling ascendency; but, during the last twelve months a new competitor has appeared, conducing materially to enhance the value of corn; large shipments having been effected

to the transatlantic ports; *America*, which was becoming the largest exporting country on the globe, feeding nearly the whole of the *new* world, the West Indian Isles, and other of our colonies, having shipped in one year nearly 2,000,000 barrels of flour, has, from the failure of the two past seasons, been rendered dependent on Europe for support. This revolution in the trade has created a fresh stimulus to foreign prices, which have been ruling high, even though the demand from England had subsided, and France and Holland retired from the market. At *Konigsberg* and *Danzig*, the speculative feeling which had prevailed previous to November, was being checked partly by the increased demands of the factors, partly by the lateness of the season and the high granary rents, and partly by the pressure on the money market, and difficulty of procuring accounts, and consequently the difficulty of holding stock. The influx of orders, however, on English and American accounts during November, the one proceeding from anticipated, the other from positive, want of supply, instigated holders rapidly to advance their demands, and each mail bringing increased and unlimited orders, the quotations were forced up to 45/ and 46/ for fine white wheat, 42/ to 44/ for fine high mixed, and 39/ to 40/ for best mixed, and red inferior 36/ to 37/; granary rents advancing to 2/ per month; all the ports situated in the lower parts of the Baltic participated fully in the excited state of the British markets; at Stettin, red marks and Silesian wheats were held at 36/, mixed Polish 38/6, high mixed 41/, white Polish and Silesian 43/ to 45/: barley 20/ to 22/; feeding oats 22/; peas 26/ to 29/. In Mecklenburg, the prices were 35/ to 36/ for red wheat; rye, 21/ to 23/; barley, 22/ to 23/; oats, being scarce, obtained 16/ to 17/; peas, 25/ to 26/. In Holstein, wheat 33/ to 35/; barley, 20/; oats, 15/ to 17/; peas, 26/ to 26/6. At Copenhagen, wheat advanced as high as 35/ to 37/; oats, 12/9 to 14/3; barley, 18/ to 19/. At Hamburg, the combined circumstances of purchases for shipment to America, and extensive English orders, rendered the trade in a very fevered state; old white Polish wheat having sold at 44/6; and fine old red marks of 63 lbs. realized 42/; and new do. of 62 lbs., 40/. Saale and Bohemian barley obtaining 28/ to 28/3; fine boiling peas, 33/6. Oats in Jutland and Danish Isles, 13/9 to 15/10; and best Iahde samples obtaining 16/4. In Holland, the crop of wheat having proved below an average, both in produce and quality, and the unfavourable weather experienced since harvest having caused much less wheat to be sown than usual, which, in connection with the American demand, and the high range of quotation in England, enhanced the value of red Rhenish wheat to 42/4 and 43/2, white Zealand 42/6 to 44/6, fine of the previous crops 43/1 to 45/1; rye, which met an active demand for America, was saleable at 25/ to 25/7. Nassau-Dietz barley 25/1; old oats obtaining high prices for our markets; New Zealand, 18/7 to 19/1; bright old and heavy, 20/ to 22/7. Groningen and Brew, 17/ to 18/6; new thick, 15/ to 16/6; new fine, 15/ to 16/6; old feed, 14/ to 15/.

When the excited feeling subsided in England, prices partially gave way at all the ports, but speculation on American account prevented any material decline, more especially as the existence of frost obstructed supplies from reaching the principal Baltic ports. On the approach of spring and intimation

of the large supplies expected from Poland, with a cessation of the demand for America, the quotations materially gave way and exhibit a difference of fully 7/ to 10/ per qr. in wheat; the lower ports being 5/ to 7/ per qr. cheaper. At Hamburg, the reduction has been 7/ to 8/, and the same in Holland. Barley, owing to a demand for Norway, and exhaustion of stocks, is not more than 2/ to 3/ per qr. cheaper; except at Hamburg, where the Saale and Bohemian barley can be now bought at 17/ to 18/ per qr., exhibiting a decline of fully 10/ per qr. Oats are reduced 2/ to 3/ per qr.

In the Mediterranean the markets participated with the enhanced prices of England and America, to which destination several shipments were made from the leading ports. At Naples, Barletta wheat was held at 37/ to 40/; Romanelli, 41/; at Leghorn, sales were effected of Odessa wheat at 35/ to 37/3; at Trieste, much animation prevailed in the trade for shipments to the Italian states and America, wheat obtaining 39/9; at Venice, soft Odessa was bought for English account at 34/10; as the demand relaxed, and the prices receded in our markets as well as the American, a gradual reduction of 4/ to 5/ per quarter has been experienced.

The Canadian markets, as it was to be expected, have been considerably influenced by the high prices the Americans have been paying for the Upper Canada wheats; causing a great exhaustion of stocks, and enhancing the quotations of superfine flour from 45/ to 60/ per brl., and Canada red wheat, at Montreal and Quebec, obtained about 1/ to 1/6 per 60 lb. advance; but as considerable shipments have been made from this country of foreign wheat, the prices on arrival are likely to recede nearly to their original bearing of 7/ to 7/6.

Comparative statement of arrivals, tonnage, and emigrants at the Port of Quebec, for the last fifteen years.

Year.	Vessels.	Tonnage.	Emigrants.
1822	586	146,188	10,468
1823	542	131,862	10,258
1824	603	148,581	6,515
1825	762	191,614	9,079
1826	794	178,792	10,731
1827	600	152,764	16,862
1828	701	183,255	11,697
1829	861	234,301	13,356
1830	855	225,138	24,391
1831	1009	259,878	49,250
1832	941	248,038	51,422
1833	1007	271,147	22,062
1834	1122	315,863	30,217
1835	1132	323,305	11,580
1836	1183	353,505	27,513

At the other North American settlements, the enhanced prices and incapability of the United States to furnish supplies has led to much privation, in the elevation of the cost price of the necessaries of life; at Halifax, Quebec flour sold at 60/ per brl. of 196 l.; Hamburg ditto at 50/ to 55/; oatmeal,

24/ per cwt. Owing also to the extreme distress experienced by the colonists, especially the small farmers, and those in the newly settled parts of the province, from the failure of the crops, and the positive scarcity of seed, both of grain and potatoes, strong representations have been made to the "Legislative Assembly," imploring assistance; and the Assembly has been, in consequence, induced to pass a bill prohibiting the export of wheat, oats, and potatoes, from the province, until the 10th of June, and from the island of Cape Breton, until the 1st of July next. The manufacture of flour in Nova Scotia was so much improved that a few barrels produced by Mr M'Donald, and sent to New York, had been marked by the Inspector of flour at that city as *superfine*. At Miramichi prices have ranged high, and some shipments have been making there from England, both of wheat and flour.

The West Indies have been drawing large supplies of flour from Europe, and at Kingston, Jamaica, high rates have been prevailing for flour and biscuit; which we are rendered incompetent to derive advantages from, as the law is at present framed, and therefore the profit has been reaped by the Hamburg, Prussian, and Danish merchants. It has, however, been found difficult to surmount the prejudicies of the inhabitants by substituting German for American flour; which is strongly instanced by the fact, that at the time when it was barely possible to obtain 50/10 per boll for good, sound, fresh Hamburg, Copenhagen and Dantzig flour, the few barrels of American manufacture which found their way to the Island, realized nearly 93/4d. per boll *currency*, including the duty of 10/ per brl.

It is now necessary to allude specifically to America, whence has originated the existing cause of so much European speculation. It will primarily be necessary to exhibit the estimated produce, and demand in the United States, premising that the deficiency is alleged to arise from the failure in the crops and the immense consumption of grain in the distilleries. The average annual production of grain has been computed as follows:—

Wheat	- -	10,000,000	Quarters.
Indian Corn	-	13,750,000	...
Rye	- -	7,500,000	...
Oats	- -	6,250,000	...
Barley	- -	625,000	...

Perhaps one half of the Indian corn, the most of the wheat, and half or three fourths of the rye is used for bread, the remainder of the rye, with a large proportion of the Indian corn, is manufactured into whisky, and the barley goes principally to the breweries; the oats, with the Indian corn, not required for bread or spirits, go for feed for horses and fattening pork. The amount of produce this season is much below this estimate. In New York, and the New England States, the Indian corn crop, it is believed, is not much above one-half the usual produce. In the great wheat-growing States of Maryland and Virginia, scarcely enough has been raised for the consumption of the inhabitants, and the whole wheat crops of the United States will probably be deficient one-third. The resources of the country for bread are, therefore, of course, correspondingly reduced. The total average annually produced of the bread stuffs; wheat, rye, and Indian corn, according to the above estimate, is 31,250,000 qrs.

Deduct one-third for the supposed deficiency, and we have a total this year in round numbers of little more than 20,000,000 qrs.; to this estimate, however, must be added whatever amount of grain has been imported from abroad; but it is believed that this resource will do little towards supplying the deficiency. If the population of the United States be fourteen millions, as a late writer supposes, and the annual average consumption of each individual, young and old, be five bushels, as estimated in Great Britain, 8,750,000 qrs. of wheat would be required to feed them, and a greater quantity of Indian corn and rye substituted. Assuming the foregoing estimate as correct, the produce, it would appear, of the past season, is more than sufficient to supply the nation with bread. If the whole could, therefore, be distributed through the country in equal portions, according to the wants of each, this partial failure of the crop would occasion no suffering. But this distribution is impracticable, and it is obvious enough that the poverty, the idleness, the improvidence, and vicious habits of multitudes, must be severely punished by the difficulties of obtaining the necessaries of life. For it must be taken into account, that large quantities of grain are consumed in the distilleries, and four or five millions of bushels, probably equal to the foreign supply, manufactured into flour for the West Indies and South American markets.

A rapid advance has been the natural consequence of the want of supply, flour at New York being noted at eleven dollars 75 cents to 12 dollars; wheat, 2 dollars 12½ cents per bushel. At Baltimore, flour 10 dollars 75 cents; and wheat, 2 dollars 28 cents. At Philadelphia, flour 11 dollars; wheat 2 dollars 25 cents. On the influx of wheat and the opening of the inland navigation in spring prices receded, as might have been anticipated from the large quantities of grain directed from all parts of Europe to the same destination, and the quotations are now 2 dollars 50 cents to 3 dollars per barrel cheaper for flour, and 70 to 75 cents on the average per bushel lower for wheat. The causes assigned, however, in America for the depreciation are different to those which are currently believed to have operated disadvantageously on the Transatlantic markets. Previous to the demand becoming urgent from America, most of the wheat in bond in England had been warehoused for three or four years, and the quantity of really good quality was very limited. Most of the early arrivals in the United States were cargoes of wheat from London and Liverpool, and few, very few, proved perfectly sound, and the same fact is applicable to a large proportion of the heavy exportations which succeeded from the more Northern European parts out of and in the Baltic. Much of the wheat was taken by the American millers as it arrived, who had on hand native grown qualities, with which admixture they were enabled to manufacture a flour that was taken into general consumption. When the internal water communication closed for the season, and home samples could no longer be procured to mix with the foreign, the flour was made exclusively of the latter, which it has been found was not suited to the tastes of the American consumers, though sold at prices even much below that of the native flour, and the disposal throughout the winter appears to have been on a comparatively limited scale. The favourable account sales of foreign wheat in the fall of the year produced larger exports from Europe, and the stocks, though they are now large at the leading ports in the United States, yet not one

tenth of the bulk is in perfectly sound condition; nor does it seem likely that the millers around New York, Philadelphia, and Baltimore, will be able to obtain such a quantity of native sound wheat as would enable them to work up much of the foreign corn before another harvest. Thus the Americans are placed in the singular position of possessing in the three principal flour marts a considerable quantity of wheat to meet their emergencies, but which is almost unavailable, in consequence of the inferiority of its quality, and the millers deprived of the power of improving the manufactured article to any extent.

Had the imports proved sound, there is little doubt the latter advices from America would have reported a very different state of the market to those received, as the cargoes would have been readily taken off at fair prices; but under the circumstances, it is to be feared that European exporters will now sustain serious losses on their shipments, as it is generally estimated that, calculating the freights and exorbitant charges, with duties no less than 1 dollar, 80 to 85 cents per bushel, on an average, will at present barely remunerate them for the speculation. In conclusion, we have extracted the following remarks from an intelligent correspondent, who, speaking of his countrymen who had imported on their own accounts, but who, by the bye, form a remarkably small proportion of the number of importers as compared with those encouraged to consign, says—"Information of the state of our markets has already gone out that will stop further shipments from your side of the Atlantic; and circumstances may arise that will induce the holders of foreign wheat, at any additionally material reduction, to take the benefit of the drawback, and re-export it to Europe. You had better let us starve for wheat bread than bring in unsound wheat." And by the last accounts from New York we find that the inferior wheats had become so great a drug, that large quantities were about to be *reshipped* to Europe.

MISCELLANEOUS NOTICES.

I. *Race Horses.*—It would be absurd to draw a comparison between the English race-horse in training, and the horse of the desert, "educated," as Mr Gibbon eloquently says of him, "in the tents among the children of the Arabs, with a tender familiarity, which trains him in the habits of gentleness and attachment." Nevertheless, we are inclined to believe that the tempers of many naturally quiet horses are made uncertain, and ofttimes decidedly vicious, by want of proper judgment, as well as good temper, in those also who have the management of them. Brutes, like men, demand a peculiar mode of treatment, when we require them to do their utmost for us; and it is certain that this principle holds good in regard to both, namely, that if general kindness gains its point, cruelty provokes resistance, and a proper degree of severity produces obedience. We often hear it asserted that the British thorough-bred horse has degenerated within the last few years, and is no longer the stout and long-enduring animal that he was in the bygone century, particularly during the last twenty years of it. We are inclined to believe that there is some truth in this. We do not think we have such good four-

mile horses, as they are termed, as formerly, which we consider easily accounted for. They are not wanted, very few four-mile races being now run, even at Newmarket or the country, and, therefore, a different kind of race-horse is sought for. It may, however, be true, that the inducement to train colts and fillies, at a very early period of their lives, for these short races, has had an injurious effect on their stamina, and, consequently, on the stock bred from them. Formerly, a horse was wanted for a lifetime, now he is cut up in his youth to answer the purpose of perhaps but one day,—a system, we admit, quite at variance with the original object of horse-racing, which was intended to benefit the community, by being the means of producing, as well as displaying, the constitutional strength of the horse in its very highest perfection. Another cause may have operated in rendering thorough-bred horses less powerful than they were, or less capable of enduring severe fatigue. During the period of high weights and long courses, horses and mares were kept on a training until after they had arrived at the age of maturity, neither did they begin to work so soon. Whereas now, no sooner have they won, or run well for some of our great three-year-old stakes, than they are put into the stud to produce racing stock, which perhaps is to be used much in the same manner as they themselves have been used, or we should have rather said, abused. But to return to the alleged alteration for the worse in the British race-horse. We admit the fact, that he is not so good at high weight over the Beacon at Newmarket, or any other four-mile course, as his predecessors were, whose descent was closer than his to the blood of Herod and Eclipse, and the descendants of that cross, said to be the stoutest of any. Nevertheless, he is, in his present form, more generally adapted to the purposes to which the horse is applied. He has a shorter but more active stroke in his gallop than his predecessors had, which is more available to him in the short races of the present time, than the deep rate of four-milers of old times; and he is now required to start quickly, and to be on his legs, as the term is, in a few hundred yards; he is altogether a more lively, active animal than formerly, and as such, a useful animal for more ends than one. But as it is action, after all, that carries weight, the thorough-bred horses of this day are not deficient in that respect, unless undersized; and there are more thorough-bred hunters at this period, and have been more for the last thirty years, than we have ever known before. This improvement of action also qualifies the full-bred horse for the road, whereas, formerly not one in a hundred was fit to ride off turf. Indeed, daisy-cutters and thorough-bred horses were nearly synonymous terms; but at present a young lady on a bit of blood is an every-day sight; and a young gentleman on any thing else in the parks, or on his road to the hounds, is become rather a rare one. —*Nimrod.*

II. *The American Wolf.*—Considerable numbers of this animal were seen on the narrow Isthmus of Boothia, where they arrive early in the spring to intercept the reindeer on their way to the north. None were killed by us during our late voyage, owing to their extreme wariness; but their tracks were occasionally seen during each of the winters. They are very troublesome to the Esquimaux, robbing their hoards, tearing the skin covering off their canoes, and killing their dogs. It is a remarkable circumstance, that a single wolf will go amongst any number of Esquimaux dogs, and carry off any one

from amongst them without the others attempting to attack it. Such is their extreme fear of the wolf, that they tremble and howl whenever they are aware of its approach. The wolf will seldom attack a man, except when starving; but, if alone and unarmed, it will not care to get out of his way.—*Captain Ross.*

III. *A New Manufacture.*—A new manufacture has been introduced into the west of Scotland—the weaving of straw hats. The straw, instead of being plaited by the hand, is woven with the loom, the warp employed being a slender thread of silk, which unites the straw firmly together, and produces a very beautiful fabric. It is woven in pieces of twelve yards long, and about an inch broad.

IV. *Canine Smugglers.*—The method of smuggling by the use of dogs is singular. A strong middle-sized dog is well fed and kindly treated at some convenient place within the French territory. He is afterwards carried over the Belgian frontier, where he is beaten and kept without food one or two days. The skin of a larger one is then stitched round him, within which fine lace, damask, or very fine Verviers cloths, or manufactured tobacco, is closely packed. The dog, thus starved, whipped, and laden, scampers off to where he has been caressed and fed, and generally escapes the vigilance of the douaniers, although, by official statements published by the French government, about one in seventy of the great number employed are stated to be shot. It is, however, estimated, that if one in twenty were destroyed, and their lading seized, there would still be sufficient profit left to encourage smuggling.—*Macgregor's "My Note Book."*

V. *Herculean Feat.*—A short time since the little village of Northiew, in this county, was the scene of much gaiety and amusement, by the accomplishment of the following extraordinary feat, by Mr Henry Evely, of that place. A bet of £5 having been previously made between him and Mr Robert Leach, of Blackforrington, that he would, within the short space of an hour, in his thrashing machine, thrash one hundred bushels of oats, and bind the straw into bundles; the performance was witnessed by almost all the yeomanry in the neighbourhood, and, extraordinary to relate, within forty-seven minutes Mr Evely thrashed 133½ bushels, and bound the straw into 240 bundles—a fact unparalleled in the annals of agricultural labour.—*Exeter Post.*

VI. *A Fact for the Naturalists.*—A correspondent informs us that he witnessed on Monday night, on one of the docks a little above Fulton-market, a regular procession of the wharf breed of rats, which was some five minutes in passing. The creatures passed, one by one, towards a particular point; and, after all had passed, our correspondent had the curiosity to examine what speculation such a multitude of the fraternity were upon. Upon a closer examination he ascertained that they had obtained an entrance into a barrel of ship-bread; and soon after every one of the animals returned, each carrying a sea-biscuit. *New York Sun.*

VII. *Influenza.*—Decker, in his *Wonderful Yeare*, printed in 1603, speaks of persons who were apprehensive of catching a disorder which prevailed at that period in London similar to the influenza, and says, "they did go, most bitterly up and downe, with rue and wormewode stuft into theyr eares and nosetrils, looking like so many bores' heads stuck with rosemerie to be served up at Christmas."

TABLES OF PRICES, &c.

The Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 3.	58 6	35 6	25 3	41 2	40 4	37 3
10.	58 4	35 0	25 3	41 0	39 10	35 10
17.	59 1	35 2	24 4	40 8	39 4	35 8
24.	57 0	33 9	24 1	40 6	39 8	32 5
Mar. 3.	58 0	32 7	24 6	40 4	38 8	35 2
10.	58 5	32 3	23 10	40 0	39 2	32 1
17.	59 1	33 7	22 11	39 7	38 8	34 2
24.	58 4	33 11	22 5	39 8	38 4	32 5
31.	56 6	33 11	22 7	38 6	38 10	33 1
April 7.	57 7	34 0	22 11	36 8	38 6	34 11
14.	58 0	33 2	23 1	36 6	37 10	34 3
21.	56 7	32 10	23 7	35 10	36 10	34 11
28.	58 5	32 6	23 10	35 4	37 2	36 10

DUBLIN.

Date.	Wheat Per Bar. 20 St.	Barley Per Bar. 16 St.	Bear Per Bar. 17 St.	Oats Per Bar. 14 St.	Flour Per Bar. 2 St.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 3.	38 4	19 2	17 2	16 6	21 1
10.	38 6	19 1	17 4	16 4	21 8
17.	38 0	19 0	17 0	16 6	21 10
24.	38 2	18 10	16 8	16 2	21 6
Mar. 3.	38 6	19 4	16 10	16 10	21 8
10.	38 10	19 10	17 0	16 10	22 1
17.	39 0	20 1	17 4	17 0	22 4
24.	39 2	20 2	17 6	17 2	22 6
31.	39 6	20 4	17 8	17 4	22 8
April 7.	39 8	20 6	17 6	17 6	22 7
14.	39 8	21 1	18 1	17 8	22 9
21.	40 2	21 6	18 8	17 8	22 8
28.	41 0	21 10	18 9	17 8	22 8

LIVERPOOL.

[redacted]	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 3.	61 0	42 6	26 1	40 10	46 6	49 0
10.	58 3	39 10	25 10	40 4	47 8	50 3
17.	58 7	39 6	23 8	40 6	47 6	49 2
24.	56 3	38 9	23 6	39 8	46 10	48 11
Mar. 3.	55 9	38 4	23 7	39 4	48 0	47 0
10.	57 4	35 8	24 4	38 6	47 6	46 3
17.	56 8	38 9	22 7	37 10	46 8	43 9
24.	57 0	38 6	23 0	37 4	45 8	43 8
31.	56 7	36 9	23 4	36 8	44 2	43 0
April 7.	53 7	32 10	20 10	36 9	42 10	43 3
14.	51 3	33 1	21 1	35 6	42 6	41 7
21.	53 4	30 4	20 10	35 4	42 0	41 8
28.	54 8	29 9	19 7	35 10	41 10	39 10

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 1.	58 9	32 10¼	28 6	45 0	46 0
8.	57 8	32 2¼	28 4	45 0	46 6
15.	58 0	34 0	29 0	46 0	47 6
22.	59 6	31 0	28 1	46 0	46 4
Mar. 1.	57 9	30 0	27 9	46 0	46 6
8	58 3	33 0	28 0	47 6	49 3
15.	60 9	34 7	28 5	47 9	49 3
22.	55 6	35 6	27 9	47 5	48 0
29.	58 6	38 10¼	29 1½	47 0	47 3
April 5.	60 1½	35 2¼	29 10	46 6	47 0
12.	61 6	34 8	31 4½	46 0	46 7
19.	62 6	34 1¼	32 0	46 0	46 2
26.	59 6	32 0	30 9½	45 0	45 6

TABLE showing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV. c. 58, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN; the Duties payable thereon, from February to May 1837.

[Dat]e.	Wheat.			Barley.			Oats.			Rye.			Pease.			Beans.		
	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.
[183]7.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
29.	57 6	58 9	28 8	35 2	35 8	9 4	24 4	24 5	10 9	41 8	41 10	9 0	38 7	39 10	11 0	40 5	41 2	8 0
5.	56 5	58 4	28 8	34 9	35 6	9 4	23 10	24 4	10 9	34 9	41 9	8 0	37 9	39 4	11 0	39 4	40 8	9 6
12.	56 9	57 11	29 9	35 7	35 8	9 4	25 3	24 2	10 9	40 9	40 6	8 6	37 7	38 11	12 0	37 11	40 9	9 6
19.	55 9	57 8	29 9	32 10	34 7	10 10	23 3	23 10	12 3	35 7	40 9	9 6	37 8	38 6	12 6	37 7	39 6	11 0
26.	55 11	56 9	30 8	32 5	34 0	10 10	23 4	23 8	12 3	35 11	39 8	11 0	36 6	37 11	14 0	38 8	39 9	12 0
5.	56 9	56 3	30 8	31 7	32 10	13 10	22 8	23 3	12 3	36 10	37 3	14 0	35 6	36 10	15 0	36 6	37 10	14 0
12.	56 7	56 5	30 8	32 9	33 5	12 4	23 1	23 6	12 3	34 8	34 0	12 6	35 11	37 4	14 0	37 0	38 6	12 6
19.	56 8	56 4	30 8	31 6	32 4	13 10	23 8	23 1	12 3	36 7	36 10	15 6	35 8	36 6	15 6	36 10	37 6	14 0
26.	56 2	56 4	30 8	31 11	32 1	13 10	22 7	22 11	13 9	36 7	31 2	15 0	35 3	35 1	15 6	37 2	37 4	14 0
2.	55 11	56 4	30 8	31 5	31 10	15 4	22 7	22 10	13 9	33 2	35 7	16 9	36 11	36 0	15 6	37 11	37 5	14 0
9.	55 5	56 3	30 8	31 0	31 7	15 4	22 8	22 9	13 9	31 11	31 3	16 9	37 0	35 1	15 6	36 11	37 1	14 0
16.	55 6	56 1	30 8	30 8	31 4	15 4	23 1	22 9	13 9	33 8	35 1	16 9	38 0	35 5	15 6	36 10	37 6	14 0
23.	55 9	55 11	31 8	30 6	31 2	15 4	23 5	22 10	13 9	35 4	34 10	18 3	38 2	36 10	15 6	37 8	37 3	14 0

The MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Quantitie[illegible] Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quanti[illegible] upon which duties have been paid for home-consumption, during the same Month; and the Qu[illegible] tities remaining in Warehouse at the close thereof, from 5th Feb. to 5th April 1837.

Month ending	IMPORTED.			CHARGED WITH DUTY.			REMAINING IN WAREHOU[SE]		
	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Tot[al]
Feb. 5. 1837.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs.
Wheat, . .	4,831 4	..	4,831 4	1,397 0	537 0	1,934 0	549,636 5	29,192 1	[illegible]
Barley, . .	18,341 1	..	18,341 1	19,853 6	..	19,853 6	5,537 4	..	[illegible]
Oats, . .	14,279 0	..	14,279 0	14,363 5	..	14,363 5	216,953 4	..	[illegible]
Rye, . . .	3,830 4	..	3,830 4	10,595 6	..	10,595 6	58 0	..	[illegible]
Pease, . .	12,655 4	..	12,655 4	13,896 7	..	13,896 7	2,166 6	..	[illegible]
Beans, . .	7,646 2	..	7,646 2	14,581 7	..	14,581 7	457 1	..	[illegible]
Totals, .	61,583 7	..	61,583 7	74,688 7	537 0	75,225 7	774,809 4	29,192 1	[illegible]
March 5.									
Wheat, . .	10,120 2	..	10,120 2	690 7	848 0	1,538 7	525,151 6	28,344 1	[illegible]
Barley, . .	19,621 0	..	19,621 0	14,785 7	..	14,785 7	9,407 4	..	[illegible]
Oats, . .	18,948 3	..	18,948 3	6,647 0	..	6,647 0	226,884 2	..	[illegible]
Rye, . . .	992 4	..	992 4	1,035 6	..	1,035 6	14 6	..	[illegible]
Pease, . .	4,498 4	6 3	4,504 7	1,733 3	..	1,733 3	4,760 1	..	[illegible]
Beans, . .	10,541 0	..	10,541 0	9,127 6	..	9,127 6	1,909 0	6 3	[illegible]
Totals, .	64,721 5	6 3	64,728 0	34,020 5	848 0	34,868 5	768,127 3	28,350 4	[illegible]
April 5.									
Wheat, . .	9,319 5	..	9,319 5	169 5	1,804 2	1,973 7	481,319 6	26,539 7	[illegible]
Barley, . .	19,730 0	..	19,730 0	6,770 0	..	6,770 0	20,427 3	..	[illegible]
Oats, . .	11,557 2	..	11,557 2	678 3	..	678 3	232,687 6	..	[illegible]
Rye, . . .	3,221 2	..	3,221 2	2,820 2	..	2,820 2	415 6	..	[illegible]
Pease, . .	9,041 6	..	9,041 6	1,917 5	6 4	1,924 1	11,306 7	..	[illegible]
Beans, . .	10,626 2	..	10,626 2	2,003 3	..	2,003 3	9,596 7	..	[illegible]
Totals, .	63,496 1	..	63,496 1	14,359 2	1,810 6	16,170 0	758,754 3	26,539 7	[illegible]
Feb. 5.	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt.
Flour, . .	10,796 0 17	243 1 0	11,039 1 17	9 1 4	185 2 20	194 3 24	168,001 3 13	6,256 0 15	[illegible]
Oatmeal, .	..	..	..	..	..	..	70 3 0	..	[illegible]
Totals, .	10,796 0 17	243 1 0	11,039 1 17	9 1 4	185 2 20	194 3 24	168,072 2 13	6,256 0 15	[illegible]
March. 5.									
Flour, . .	21,442 0 6	..	21,442 0 6	777 0 19	831 1 0	1,608 1 19	162,778 0 2	5,685 3 22	[illegible]
Oatmeal, .	176 0 13	..	176 0 13	..	..	..	246 1 17	..	[illegible]
Totals, .	21,618 0 19	..	21,618 0 19	777 0 19	831 1 0	1,608 1 19	163,024 1 19	5,685 3 22	[illegible]
April 5.									
Flour, . .	36,184 0 11	1,914 3 0	38,098 3 11	118 0 21	1,470 1 10	1,588 2 3	168,225 3 27	6,406 3 12	[illegible]
Oatmeal, .	1,434 2 2	..	1,434 2 2	..	..	..	754 1 22	..	[illegible]
Totals, .	37,618 2 13	1,914 3 0	39,533 1 13	118 0 21	1,470 1 10	1,588 2 3	168,980 1 21	6,406 3 12	[illegible]

PRICES of BUTCHER-MEAT.

Date.	SMITHFIELD, *Per Stone of* 14 lb.		MORPETH, *Per Stone of* 14 lb.		EDINBURGH, *Per Stone of* 14 lb.		GLASGOW, *Per Stone of* 14 lb.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1837.								
Feb,	8/3 @ 9/3	8/3 @ 9/6	7/9 @ 8/9	8/6 @ 9/6	7/3 @ 8/	7/6 @ 8/3	7/6 @ 8/6	7/6 @ 8/6
Mar,	8/3 9/6	8/6 10/	7/9 9/	8/9 9/6	7/6 8/3	7/9 8/6	7/9 8/6	7/9 8/3
April,	8/6 10/	9/ 10/3	8/6 9/3	9/ 10/	7/9 8/6	8/6 9/3	8/6 9/	8/3 9/

PRICES of English and Scotch WOOL.

ENGLISH, per 14 lb.—*Merino*, 26/ @ 30/; In Grease, 20/ @ 24/.—*South Down*, 20/ @ 23/2; *Leicester*, [illegible]g, 20/ @ 23/6; Ewe and Hogg, 16/6 @ 21/6.—*Locks*, 11/ @ 13/; *Moor*, 9/ @ 11/.

SCOTCH, per 14 lb.—*Leicester*, 20/ @ 22/; Ewe and Wether, 15/6 @ 17/6.—Ewe, 14/ @ 16/6: *Cheviot*, white, 14/ @ 20/; Laid, Washed, 9/6 @ 13/; Unwashed, 7/6 @ 11/6; *Moor*, White, 7/ @ 8/; Laid, Washed, [illegible] @ 7/6; Unwashed, 5/[illegible] @ 6/6.

THE REVENUE.

***ABSTRACT** of the Nett Produce of the Revenue of Great Britain, in the Quarter and Years ended on the 5th of April 1836, and 5th of April 1837,—shewing the Increase and Decrease on each head thereof.*

	Quarters ended April 5.		Increase.	Decrease.	Years ended April 5.		Increase.	Decrease.
	1836.	1837.			1836.	1837.		
	£	£	£	£	£	£	£	£
Customs, . .	4,449,838	4,436,505	. .	13,333	18,785,867	19,703,107	917,240	. .
Excise, ...	1,863,312	1,834,443	. .	28,869	11,720,498	12,715,305	994,807	. .
Stamps, . . .	1,697,884	1,618,462	. .	79,422	6,612,806	6,670,999	58,193	. .
Post-Office,	366,000	367,000	1,000	. .	1,425,000	1,491,000	66,000	. .
Taxes, ...	189,064	187,219	. .	7,845	3,620,223	3,681,916	61,693	. .
Miscellaneous,	16,743	26,334	9,591	. .	65,621	50,421	. .	15,200
	8,582,841	8,463,963	10,591	129,469	42,230,015	44,312,748	2,097,933	5,200
	Deduct Increase,			10,591	Deduct Decrease,		15,200	
	Decrease on the quarter,			118,878	Increase on the year,		2,082,733	

***FIAR PRICES** of the different **COUNTIES** of **SCOTLAND**, for Crop and Year 1836, by the Imperial Measure.*

ABERDEENSHIRE.

	Imp. Qr.
Wheat, without fodder, .	47/
Barley, without fodder, .	28/6½
Bear, without fodder, . .	27/3½
Oats, Best, without fodder,	23/7
——— with fodder, .	34/7
—— Second, without fodder,	22/4
——— with fodder,	33/4
Pease and Beans.	32/
Oatmeal, per Boll, 140 lb, .	18/

ARGYLE.

Bear, ...	28/4
Oats, ...	24/
Beans, ...	48/
Oatmeal, per Boll, 140 lb, .	21/11½

AYR.

Wheat, ...	48/1
Barley, ...	34/11½
Bear, ...	26/6
Oats, ...	22/1
Pease and Beans, ...	45/11
Oatmeal, per Boll, 140 lb, .	22/11

BANFF.

Wheat, ...	50/6
Barley, without fodder, .	32/
——— with fodder, . . .	39/6
Bear, First, without fodder,	30/
——— with fodder, .	37/6
—— Second, without fodder,	23/8
——— with fodder, .	31/2
Oats, Potato, without fodder,	24/6
——— with fodder, .	34/6
—— Common, without fod.,	22/6
——— with fodder,	32/6
Pease, ...	32/8
Beans, ...	31/
Oatmeal per Boll, 140 lb, .	19/

BERWICKSHIRE.

	Imp. Qr.
Wheat, ...	49/2
Barley, Merse, ...	29/9½
——— Lammermuir, . .	27/1¼
Oats, Merse, ...	26/10½
——— Lammermuir, . .	23/7
Pease, ...	41/2½
Oatmeal, per Boll, 140 lb,	20/1½

BUTE.

Wheat, ...	42/8¼
Barley, ...	31/3½
Bear, ...	28/3½
Oats, ...	23/10
Pease, ...	38/
Beans, ...	38/
Oatmeal, per 140 lb, . . .	22/

CAITHNESS.

Bear, ...	23/4½
Oats, Potato, ...	23/9
—— Early Angus, . . .	25/
Oatmeal, per 140 lb, . .	18/7

CLACKMANNAN.

Wheat, ...	46/8½
Barley, Kerse, ...	29/4
——— Dryfield, . . .	29/5½
Oats, Kerse, ...	23/1
—— Dryfield, ...	22/9½
—— Black, ...	24/0
Pease and Beans, ...	45/9
Malt, ...	55/3
Oatmeal, per Boll, 140 lb,	22/6

DUMBARTON.

Wheat, ...	48/6
Barley, ...	30/7
Bear, ...	27/5
Oats, ...	25/3
Pease and Beans, ...	44/6
Oatmeal, per 140 lb, . . .	22/8

DUMFRIESSHIRE.

	Imp. Qr
Wheat, ...	52/10
Barley, ...	32/
Bear, ...	30/8
Oats, Potato, ...	25/10
—— White, ...	24/4
Pease, ...	45/4
Beans, ...	43/8
Rye, ...	34/8
Oatmeal, per 140 lb, . .	20/10

EDINBURGH.

Wheat, First, ...	54/
——— Second, ...	47/
Barley, First, ...	32/
——— Second, ...	28/
——— Third, ...	24/
Oats, First, ...	27/6
——— Second, ...	22/
Pease and Beans, ...	42/
Oatmeal, per Boll, 112 lb,. .	17/2½

ELGIN AND MORAY.

Wheat, ...	50/3½
Barley, ...	32/6½
Oats, ...	23/2½
Rye, ...	33/5½
Pease and Beans, ...	40/
Oatmeal, 112 lb, ...	15/4½

FIFE.

Wheat, White, ...	44/7
——— Red, ...	43/3½
Barley, ...	29/1½
Bear, ...	27/1½
Oats, ...	24/5½
Pease and Beans, ...	34/2
Rye, ...	28/8
Malt, ...	52/6
Oatmeal, 280 lb, ...	43/2½
——— by measure, . . .	41/2½

FORFAR.

Wheat, ...	47/1
Barley, ...	28/9
Bear, ...	24/1
Oats, Potato, ...	25/10
—— Common, ...	[illegible]
Pease and Beans, ...	
Rye, ...	
Oatmeal, ...	

HADDINGTONSHIRE.

	Imp. Qr.
Wheat, First,	58/5½
——— Second,	52/11¾
——— Third,	49/1
Barley, First,	40/3½
——— Second,	36/3¾
——— Third,	32/7¾
Oats, First,	30/1½
—— Second,	27/9
—— Third,	25/5¾
Pease and Beans, First,	43/7½
——— Second,	37/8¾
——— Third,	34/4

INVERNESS.

Wheat, without fodder,	45/8
——— with fodder,	53/
Barley, without fodder,	31/6
——— with fodder,	37/6
Oats, Potato, without fodder,	25/
——— with fodder,	31/6
Oats, Common, without fod.	24/6
——— with fodder,	31/
Oatmeal, per Boll, 112 lb,	16/10

KINCARDINE.

Wheat, without fodder,	52/9
——— with fodder,	63/9
Barley, without fodder,	28/2
——— with fodder,	34/8
Bear, without fodder,	24/5
——— with fodder,	30/11
Oats, Potato, without fodder,	24/2
——— with fodder,	32/2
——— Common, without fod.	22/9
——— with fodder,	30/9
Oatmeal, per 140 lb,	19/6

KINROSS.

Wheat,	44/2
Barley, First,	27/6
——— Second,	22/
Bear, First,	23/
—— Second,	16/
Oats, White, First,	23/6
——— Second,	16/
——— Black, First,	16/
——— Second,	12/
Pease and Beans,	26/
Oatmeal, per 280 lb,	43/

KIRKCUDBRIGHT.

Wheat,	46/2
Barley,	32/10
Oats, Potato,	23/10
—— Common,	22/4
Oatmeal, per Boll, 140 lb,	20/2½

LANARKSHIRE.

	Imp. Qr.
Wheat, First,	51/3½
——— Second,	41/7½
Barley, First,	29/10
——— Second,	26/9
Bear, First,	26/8
Oats, First,	24/2½
—— Second,	19/4½
Malt, duty included,	58/
Oatmeal, per Boll, 140 lb.	23/1½
——— Second,	20/7½

ARCHBISHOPRIC OF GLASGOW.

Barley,	30/2½
Oats,	25/2
Oatmeal, per 140 lb,	23/6½

LINLITHGOW.

Wheat,	47/5
Barley,	32/4
Oats,	26/1
Pease,	38/7
Malt,	53/
Oatmeal, per 140 lb,	22/1½

NAIRN.

Wheat,	49/6
Barley, without fodder,	31/
——— with fodder,	41/
Oats, without fodder,	22/6
——— with fodder,	36/
Oatmeal, per 112 lb,	15/6

PEEBLES.

Wheat, First,	56/3¾
——— Second,	52/3
——— Third,	45/11½
Barley, First,	33/
——— Second,	29/9½
——— Third,	26/9½
Oats, First,	25/10
—— Second,	23/0½
—— Third,	19/1
Pease, First,	37/10½
—— Second,	35/11½
—— Third,	30/
Oatmeal, First, per Boll, 140 lb,	17/2
——— Second,	16/8½
——— Third,	15/9

PERTH.

Wheat, First,	52/1
——— Second,	41/5
Barley, First,	32/1
——— Second,	24/8
Oats First,	26/1
—— Second,	21/8
Pease and Beans,	34/9
Oatmeal, per Boll, 140 lb,	21/5

RENFREWSHIRE.

	Imp. Qr.
Wheat, First,	47/8
——— Second,	46/8
Barley, First,	29/9
——— Second,	29/1
Bear,	27/5
Oats, First,	23/10
—— Second,	21/11½
Pease and Beans,	
Oatmeal, per Boll, of 140 lb,	22/6
——— Second,	22/4

ROSS AND CROMARTY.

Wheat, First,	50/2½
——— Second,	38/2
Barley,	32/6½
Bear,	25/
Oats, Potato,	24/11
—— Common,	24/½
Oatmeal, per Boll, 140 lb,	20/1½

ROXBURGH.

Wheat,	51/2½
Barley,	31/1½
Oats,	26/
Rye,	32/
Pease,	39/9
Beans,	41/8½
Oatmeal, 140 lb,	20/5¾

SELKIRK.

Wheat,	51/
Barley,	28/1
Oats, Potato,	26/2
—— Common,	23/8
Pease,	43/7
Oatmeal, per 280 lb,	42/

STIRLING.

Wheat,	44/4
Barley, Kerse,	32/
——— Dryfield,	30/
Oats, Kerse,	24/8
—— Dryfield,	22/4
—— Muirland,	17/4
Pease and Beans,	41/
Malt, duty included,	58/
Oatmeal, per Boll, 140 lb,	21/6

SUTHERLAND.

Barley,	33/4
Oats, Potato,	26/6
—— Common,	25/
Oatmeal, 140 lb,	20/9

WIGTON.

Wheat,	50/2
Barley,	31/3
Bear,	26/4
Oats, Potato,	22/6
—— Common,	21/2
Pease and Beans,	40/6
Rye,	36/4
Malt,	71/6
Oatmeal, 280 lb.	40/

We may inform our English Readers, that the Fiar Prices are the average prices of grain as ascertained every year by the verdicts of Juries in every county of Scotland. These Juries are summoned in Spring, and ascertain from the evidence produced to them the average prices of the preceding crop. By these prices, rents payable in grain, and similar contracts, are generally determined; but the main object is to convert into money the stipends (for the most part payable in grain) of the Scottish Clergy.

THE QUARTERLY JOURNAL OF AGRICULTURE.

ON IRELAND.

We have occasionally made observations on the state of tillage, &c. in single counties in Ireland, and hope to do so again, but in the present article we shall sketch a general outline of that important portion of the British Empire as it appears in the present year in its principal agricultural lineaments. But, first, the important question arises, Are the agriculturists themselves improved in their habits and condition? and what are now the actual circumstances of relation between the proprietors of the soil and their tenantry of every grade, from the humble cottier to the consequential middleman? We shall first look at the circumstances of the farmer himself.

The consolidation of small farms, which has been gradually progressing since the abolition of the forty-shilling-freehold system (which obviously favoured the minute subdivision of land by rendering it the interest of the landlord to multiply the small holders), has decidedly improved what may be termed the farmers' class; these possess cattle and implements, the means of manuring their farms, &c., and are generally elevated in their grade to a degree unknown to their forefathers. As far as regards the agricultural condition of the country, the junction of small farms has had a beneficial result. It is superfluous to attempt a proof of what must be obvious to every intelligent reader—subdivision leads to a considerable waste of land in

ditches and fences, to the keeping of a numerous body of miserable inefficient horses, to the destruction of the confines of every highroad, the diminution of produce as to quality, and its deterioration as regards its quantity. This is remarkably exemplified where grass or dairy farms abound; wherever several cows are kept in one dairy, the produce is generally of the first quality, but if one or a few only are kept, it is not so good, as it requires a number of churnings to fill the firkin, causing a difference in the colour; but in large dairies it is packed after one churning, and is therefore of uniform quality. A small farmer—of course we mean generally—cannot afford, if his allotment exceed such a patch as he can cultivate with the spade (for where a good system of garden husbandry is practised, how rare the case! we fully admit the superiority of tillage on a minute scale), to till as well as the large farmer; he can neither create, nor in any way procure manure in sufficient quantity, except in the vicinity of the sea-coast or in the outlets of a town, nor purchase *good seed;* and although on a small as well as large scale a systematic course of cropping may be pursued, the fact is—from the necessity of raising potatoes for domestic consumption—that a rotation system *is* very rarely adopted among the smaller tribe of tenantry. We are certain that the acreable produce of land has been greatly increased since the consolidation of small farms, because the former occupiers were unable to apply fertilizing matter, and consequently rendered the land effete by successive crops of potatoes insufficiently manured, or of corn without any alternation of green crop or *rest* from its abortive labour; and we add, in our estimate of advantage from consolidation, the actual gain of land—perhaps one-twentieth—previously occupied by miserable fences. Besides, the occupiers of small farms are often unable to cultivate them entirely from not having the means of employing stipendiary labour, and in many instances, from being exceedingly lazy, they leave a portion of their holdings in a totally unproductive state.

The effect of the consolidation of farms is decidedly favourable to the landlord's interest. The landowner is better paid, and with less trouble, than when he had a greater number of tenantry, even though they might have promised larger rents; and, even granting that small farms are generally set at a higher

rate than large ones from the number of competitors, yet the irregularity and uncertainty in the actual payments of rents will more than counterbalance the deficiency of nominal value, which often leaves the real amount uncertain, leading the landlord into an expenditure beyond his means, and inducing him, in the embarrassment of his affairs, to exact his rack-rents with severity and ruin to his overcharged tenantry. Many landlords have swelled their rent-roll with the worst results to themselves; but this system is rapidly giving way to the more judicious plan of setting land for the real value, allowing landlord and tenant a fair remuneration.

Supposing, on an average of years, that one hundred acres are let to one man, and the same quantity let to ten men, we are of opinion that the landlord will gain more in the first than in the second case, especially if the land be poor, and consequently in need of capital and enterprise in the management, except in those parts of Ireland—for example, the baronies of Forth and Bargie in the county of Wexford—where the land is particularly suited to tillage, and is contiguous to the coast. In such case one-fourth more would probably be paid to the landlord by ten occupiers of one hundred acres than by one tenant of the same extent. It is easier also to find ten men with adequate capital for ten acres each, than one tenant with the means of fully cultivating one hundred. Farms of about thirty acres each, considering the circumstances of the country, would be perhaps the most beneficial for all parties.

In the neighbourhood of large grazing farms the condition of the labourer is miserable, although that of the landlord and tenant is peculiarly good, the class of persons occupying such farms being generally capitalists, and the farms of the best quality. The privations of the peasantry in the rich grazing lands of the counties of Tipperary, Limerick, Clare, Meath, &c. are, when contrasted with the portly figures and purse-proud carriage of the extensive graziers, quite sufficient to render us desirous of the introduction of alternate husbandry in those districts, for it is in those places the lowly cottier is ground to the earth, and exhibits all the stern reality of woe and misery, which is not always of the enduring and passive kind.

The proportion of land under grass to that under tillage has

not varied throughout Ireland during the last five years, the changes from the one system to the other being obviously caused by the relative prices of corn, meat, and butter, and these commodities have continued to each other the same ratio during the period we have stated.

From the commencement of the clearing system preparatory to the junction of farms within the last two or three years, the ejected tenants were forced to take refuge in towns and villages in search of employment and food, or to emigrate to America, yet not in sufficient numbers to lessen the competition for labour and for small holdings, to raise the wages of those who remained at home, or to reduce rents. These emigrants, on their eviction, generally possessed only a few articles of furniture, with a cow or two, and a little money; in some instances the produce of part of a crop. Some of those who remained contrived to get a patch of land at a rack-rent, or *squatted* in a hovel by a bog-side. In some instances the landlords paid them liberally, and in all cases defrayed the expenses of emigration. While the rage for emigrating (result of sad necessity) prevailed, some surrendered their farms for the bare means of a passage to America, whilst others, more fortunate in the generosity of their landlords, or the peculiarity of their tenures, were paid considerable sums for voluntarily abdicating their holdings, and seeking employment and location in America. The tide of emigration has, however, now ceased to flow with rapidity, and the clearing system, preparatory to the consolidation of farms, has greatly abated in its force. Were there not serious impediments to a consolidation of farms on a more extended scale, arising from the unpopularity of such a measure, and the certainty in some counties of agrarian outrages to a frightful extent, the class of small-holders would disappear; and, besides the fear of outrage, the apprehension of danger to life and property (which so generally prevents the eviction of small farmers, *or even the substitution of one tenant for another* on the same allotment)—the feelings of humanity have often operated to prevent a more rapid junction of farms. Even if a fund were provided for the support of the evicted tenants until they could find work, their animosity to those who had taken their farms would be perpetual. Their local attachments are so strong, that they would prefer

remaining on the spot where they first drew breath to any provision elsewhere, which *was not decidedly* more advantageous.

The prevention of subdivision is now so secured by legislative enactments, that it is needless to introduce non-alienation clauses in new leases; tenants are now so restricted from allowing strangers or cottiers to settle on their farms, that a gradual diminution of the evils arising from a pauper-population of rural occupiers, which have so long affected Ireland, may be looked upon as certain. The class of land-agents, too, has improved in a degree corresponding with the increased skill and energy of practical farmers. We hope, and even believe (though it is hard to ascertain this point) that the old system of making *handsome compliments in money* to the agent or his wife on the signing of leases, is silently disappearing. On some of the great estates a *scale* of small fees is, we believe, authorized by the landlord,—this claim is fair and above board,—but the silent and pilfering system on the part of the agent, to the manifest injury of the landlord and tenant, no longer prevails; nor do agents either under the Courts of Chancery or Exchequer, or private individuals, take bribes for giving time to *make up the rent.*

It is not now usual to grant leases for more than one life or twenty-one years, with reservation of mines, minerals, and game, although three lives and thirty-one years are sometimes given where buildings and other permanent improvements are expected, and it is found that the latter term is often necessary to give sufficient encouragement to the tenant, who naturally wishes to have the lives of his children in his lease, but the former term is generally sufficient, as it does not render the tenant independent of his landlord, although it induces a fair expenditure of capital. The introduction of covenants against injudicious cropping, &c. have (if ever introduced) never been acted upon in Ireland, and any clauses to compel a good system of farming would assuredly prove unavailing; the difficulty of enforcing them prevents many intelligent and improving landlords from introducing them, although anxiously desirous of having them acted upon. On short leases during minorities, tenants have been, in a few instances, restricted from selling straw, instead of converting it into manure on the farm, but we hear of no covenants binding the

tenant to keep in a specified state of repair the houses, offices, and fences, or even to cut turf-bogs in an economical and uniform manner, so as to admit of the levelling and forming of the substratum for ultimate culture; against burning are private covenants as well as legislative enactments. The paring and burning of bogs such as the generality of those in Ireland, in the first instance, is by no means injurious, the redundancy of vegetable matter and of injurious acids requires this operation, and the landlord has only to guard against a repetition of the practice, or excessive cropping afterwards, and insist on the application of lime to the torrified surface.

Whilst we are on the subject of leasing we must add, that it *sometimes* occurs that the landlord, if not strictly limited will, either from anxiety to supply his extravagancies, or to serve younger children, at the expense of the son and heir, give long leases for a *consideration*. It is now happily very unusual to let farms in *common*, the joint tenantry system being decidedly injurious to the *industrious* tenant, and often productive of disputes among the parties, for each is by the lease answerable for the rent of the other, and a feeling of insecurity arises on the part of all those concerned in the lease. When large tracts of mountain or other grazing land has been let to a number of tenants, perpetual jealousies and differences as to the number and size of the beasts each is to feed, &c. have generally existed among the parties. Unlimited leave for tillage is always allowed on small holdings, and the instances, even on large farms, in which clauses are introduced to keep a certain portion under grass, are rare.

From the present political circumstances of the country much of the land is held at will, the Protestant landlords in general being afraid or unwilling to dispossess their Roman Catholic tenantry, and yet out of regard for the constitutional interests which they desire to preserve, unwilling to enfranchise them, knowing that the freehold privileges of their tenants would be in most cases exercised in obedience to the democratical leaders, and decidedly in opposition to the sentiments of the great majority of the landed proprietary.

While the present state of political warfare continues,—and we see no reason to prognosticate a speedy termination to party

differences—the improvement of those farms which are held *at will* cannot be expected, and farm-buildings, &c. will be allowed to dilapidate just as they were fifty years ago, when the proprietors, acting in the opposite extreme, through the desire of fixing rents, and with the desire of avoiding pecuniary dealings with a pauper tenantry, gave very long leases (without restriction of subletting) to the neighbouring occupiers of large farms, or to mere speculating middlemen.

Towards the expiration of any lease, long or short, if the tenant have not the certainty of renewal at the same rent, he does every thing in his power to exhaust the land, for if he leaves it in a good state, he anticipates an increased rent on a renewal, and if he be ejected, he wishes very naturally to have had as much *out of the land* as possible, entertaining no very amiable feeling towards his successor.

This system, resulting from want of mutual confidence between landlord and tenant, has unquestionably tended to diminish the quantity of production, as well as to cause the dilapidation of fences and buildings throughout entire districts, when leases have approached their termination.

The only effectual mode of obviating the exhausting process on the part of tenants, circumstanced as we have now supposed, would be to compel landlords to take all improvements and growing crops at a fair valuation, and to render the tenant liable to pay damages for wilful neglect of the land; but this would occasion great hardship to landlords, who would be wofully cheated if such power were vested in the tenants.

Although much has been already expressed in this Journal, about the injurious results of the middleman system in Ireland, we cannot here avoid another glance at the subject, in order to have a parting blow at them. But first, What is a middleman? Is a man holding a lease for ever, to be considered as such? Not, in the obnoxious sense of the term. Well, then, define a middleman, What is the greatest or shortest length of lease which constitutes a middleman? This is not easily defined. We feel something of the same sort of difficulty in which we should be involved, if desired to define an Absentee in precise phraseology.

It is hard to fix the length of lease which constitutes a middleman; there is much land held from the chief proprietors by

middlemen, who have really the whole beneficial ownership in their own power, paying extremely small rents under very old leases, renewable for ever, yet reserving the fee to the head landlord. These persons, though strictly so, can hardly be termed middlemen; they do not stand between the landlord and tenant, in such a relation as necessarily leads them to *grind* the latter, in order to leave themselves some profit rent; in fact, their rent is almost all profit, and they have a *direct* and *permanent interest* in the *prosperity of the tenant.* They fairly represent the head landlord, and may be placed for all practical and legislative purposes in the class of the proprietary. The quantity of land not held from the proprietor in fee, but through *intermediate interests*, is very considerable.

There is much land in the north, and some in the south of Ireland; for instance, the properties and endowments belonging to Trinity College, Dublin, held by middlemen. Persons of this description hold leases of the endowments of charitable institutions, and estates possessed by ecclesiastical corporations. The *transient nature* of the interests which bishops, colleges, and all other corporations *individually* possess, in land property, necessarily renders them less anxious for its improvement in any respect, than if they anticipated prospective and permanent interests to themselves. The condition of labourers and small holders, however, is not worse on such estates managed by middlemen, than on any other description of property in the hands of these land sharks. We except, as already intimated, from the condemnation so justly due to middlemen as a class, all those who hold properties under a long term of years, and who are rather to be considered landlords, whose duties they frequently discharge with fidelity and credit, as if conscious of their responsibility and moral stewardship. The *real* middleman, who pays nearly the value to his landlord, exacts all that he can from his tenant, in order to support his own expenses, which are generally much above his true condition in life, and if the head landlord, anxious to better the condition of the lowest tenants, were to make a reduction in rent, in expectation that the *occupiers* would keep their farms in heart, he would have no certainty that the middleman (or each middleman from one to the other, supposing a series of them) would

make an equal allowance to the occupier. The presumption is, in most cases, that if the head landlords were to give a specified sum regularly to the occupier, by way of reduction of rent, the middleman would increase the rents, and thus frustrate the kind intentions of the proprietor; no *dependence* could be placed on the great body of middlemen, though there are many honourable exceptions. If the head landlord were to take it into his head to expend capital in improving the holdings of the subtenants, or to assist them in forming drains, fences, dressing their houses and gardens, &c., the middlemen would often avail themselves of his liberality, by adding an increased rent to the cottiers or little farmers on the first opportunity.

How, then, can the best inclined proprietors serve their estates while these intermediate possessors are in the way? But happily these locusts of the land are rapidly disappearing; they have been devouring the substance of the soil, and that which formed their subsistence was neither rent to the landlord, nor profit to the tenant. They have been a dead weight upon the country (we still except a numerous portion—those with long and beneficial leases) living on the industry of others,—*fruges consumere nati*, unless in the cases in which they have made a recompence to the community, by exhibiting in their lives, moral excellence, and on their own farms improved husbandry and thrifty management.

The class of persons by whom grazing farms are generally occupied, is far more wealthy than that employed in tillage. It requires a much greater capital to stock a grazing farm of any given extent than to till it. Immediate return is what the great mass of Irish agriculturists stand in need of, and if they have cattle to plough their land, and the means of providing seed, they have only a short period to wait for the crop, which they thrash out and convert into cash with great promptitude. We have no doubt that advantage would arise to the holder of the land, as to the labouring poor around, if much of the lands which are devoted to grazing, were occasionally in tillage,—these lands being usually of the best quality. The increase of food which might be effected by the green crop system would, of course, furnish *a greater supply of fat cattle*, to the obvious advantage of all classes, but the grazier satisfied with his profits

without any trouble, will not undertake the labours and anxieties of farming.

Obstinacy in adhering constantly to the feeding system, as we have on a former occasion noticed, has been the cause of many of the agrarian disturbances in Clare and Limerick; if the grass lands were to a greater extent converted into tillage, additional employment would be afforded to labourers, who, by the way, are placed on the poorest portions of these grazing farms, contrary to every fair principle, which should prompt the farmer to take care that the *little patch* from which his cottier is to derive food, should be of good quality. The labourers of a rich grazing district are much less employed, and consequently much less comfortable, than on poor soils, where tillage prevails.

The soil, in the tillage districts of Ireland, is unquestionably improving (especially near the sea-coast), from the constant admixture of sea-sand and sea-weed, from the increasing application of lime, and advancing skill in draining; the class of snug farms, from 30 to 50 acres, with good slate houses, garden and orchard is increasing; and on the whole, taking corn, cattle, sheep, butter, and cheese into calculation, there is probably a third more of produce raised now than formerly. The culture of grain crops is much better than formerly; the use of the roller is becoming general; but the harrowing of wheat, previous to rolling, is yet very unusual.

From the dampness of the climate, and the practice of sowing much of the wheat on leys not broken down, the colour and general quality of the wheat is very inferior to that of English growth. Fallowing for this grain prevails in some counties, as in Kildare and Kilkenny, but is not practised in others; in Wexford, for example, the usual practice is, after marling on ley, to plough the field into narrow ridges, and to cover the seed from the furrows with spade and shovel, or to break up a clover ley in September, and sow it after a single ploughing and harrowing. As to subsequent care, thistles are usually taken out in May or June, to save the reapers' fingers in harvest, but not always, and other intruding weeds are unmolested.

Wheat is generally steeped in brine before sowing, to prevent smut; it is *always* sown too thickly, and from mistaken economy is allowed to ripen too much.

Unhappily very usual, we may say general, with the

small holders, to thrash and sell off corn in October and November, but a vast body of large independent farmers hold over their corn until the most favourable season for selling, and not unfrequently for two years. The loss to the humble husbandman by the lowness of price from the pressure into the market immediately after the harvest, deprives him of the pecuniary advantage which *he* so especially requires, and the only reserve which he ever thinks of making besides that of seed, may be one or two barrels of oats for meal in the ensuing summer; yet, though he suffers a loss in price from the great influx of supply sent to market by the necessitous farmers immediately after harvest, the actual and eventual loss may not be so great, the diminution in *weight* * on corn long stored, and the waste of grain from vermin or general casualties, being often very considerable.

As may be supposed, the small holders, and indeed the great mass of common farmers, are very careless about the quality of grain which they use for seed, and there is not sufficient care taken by the proprietors to introduce fresh and superior seed at a cost within reach of the poorer farmer, who is often obliged to purchase bad seed from his neighbour on credit at an exorbitant price; but there is now much more anxiety on this subject than formerly.

Ireland abounds in manure, limestone (burned with coal or turf, or furze faggots, according to local circumstances), marl, white and blue, limestone gravel, sea-wreck and calcareous sand; and wherever these manures abound, there are now the necessary facilities for procuring them, and rendering them available, by roads, kilns, fuel, &c. The habit of littering cattle causes a supply of animal and mixed manures to an extent unknown thirty or forty years ago; and in numerous instances the systematic attention paid to the dung-yard for the collecting of materials for manure is most creditable to the thrift and intelligence of the agriculturists. In the neighbourhood of towns in which *amateur* farmers, on a small scale, so often are found, bones, soot, malt-dust, soap-boiler's waste, oyster-shells, as well as street-scrapings, are freely used, and make a proportional return in produce.

Sea-weed, which periodically abounds in many parts of the

* In *bulk* rather; for grain becomes drier and heavier by keeping, and of less bulk when dry.—EDITOR.

coast, is applied in various ways; in some places by admixture in compost with earth and sand (the best mode); in others on the surface, thinly spread over stubble, in autumn and winter, and then ploughed in on the potato beds or drills in summer, immediately before or after the planting of the crop.

But the *influence* of this manure, whether applied fresh or after putrefying, and being mixed with other matters, does not last long; it yields, however, a crop of potatoes, succeeded by oats or barley, but in some seasons it is unfavourable to potatoes. The peasantry are so prejudiced in its favour as to draw it to a considerable inland distance, when they might procure lime on cheaper terms, if they properly estimated the value of their time and labour in collecting and drawing this bulky and weighty substance, or had *money* for the purchase of the lime. In the immediate vicinity of the coast, this weed is of prodigious value to the cultivators of the soil.

Enclosures and fences are often miserably bad, and the loss of property, from injury to cattle, trespass, litigation, is considerable; and breaches of the peace, and the labour expended in continually making temporary fences, are often more than would be necessary to form permanent fences.

Draining is yet very defective in Ireland, though greatly improved. Sufficient efforts have not been made to deepen or alter the course of brooks and rivers, and to prevent inundation. We are familiar with many places where embankments and drains would secure large portions of alluvial soil—now waste; and we have no doubt that if improvements of this kind were undertaken by societies or individuals, the expenditure of capital would be amply repaid, and during the progress of the work, would absorb all superabundant labour. There are countless acres of wet land requiring only shallow drains; from 50 to 150 perches of these, per acre, at 4d. per perch, would totally remove the diseases of the land, which arise from confined moisture; and there is no kind of labour which would so effectually repay the outlay of capital to landlord and tenant, by permanently increasing the produce of the land; cheapness of labour, and the ordinary price of potatoes being considered.

There are few districts now in which there are not numerous roads to market towns in sufficient repair; and the quantity of [illegible] are now conveyed by a single horse on improved vehicles is

more than double that which was carried twenty years ago; this improvement of conveyance has of course tended greatly to the advantage of all classes of society; the consumer of the produce has it on lower terms, and, especially with regard to the relative interests of landlord and tenant; if the former has an increased rent, the latter has increased means of paying it, and as the age advances in improvement, we expect to see the most mountainous and remote districts gradually connected with the market towns by roads easily traversed. There was a time perhaps, when the Irish mountaineer would have resisted the making of roads to his location, lest higher rent should be expected from him in consequence; but if such opposition was ever likely to have occurred in former years under such circumstances, the experience and increased intelligence of the peasant, would now lead him to see clearly that the rendering of his tract easily accessible, would directly serve himself.

Ireland, too, generally exhibits great waste of land in useless fences, headlands, untilled corners of fields, exhausted quarries, and marl-pits, denuded bogs, &c., which waste is always measured and generally paid for as profitable land.

It is a subject of regret that the Irish farmers are not yet aware of the advantages of green crops and alternate husbandry. Clover is, however, much more in use than formerly; as to turnips, they are almost totally unknown to the small holder as food for cattle, but he cultivates more potatoes than formerly, and in many instances a considerable portion of this crop is used by cattle. The lumper potato is much cultivated for this purpose, and will flourish where (from want of manure) a turnip will not suceed. Altogether, the culture of potatoes has greatly increased since the effects of lime, in their production, have become so generally ascertained, and the demand for fat cattle,—consequent on the rapid intercourse between Ireland and England,—has rendered house-feeding of cattle profitable; and there is no better food for fattening cattle.* The breed of cattle has greatly improved, the gentry and large farmers having imported bulls and cows of a superior kind. A cross from the short-horned is now very common, and vast numbers of Ayrshire cattle have been brought over to this country; but the *Irish* breed, somewhat improved, is general among the lower

* Particularly when mixed with chopped straw.—EDITOR.

classes of farmers. The average price of a good dairy cow may be stated at L.10. The *condition* of dairy and cattle sheds, and the construction of dairies, is generally very defective and exceedingly slovenly. The price of bulls varies considerably; some are imported at great expense, and their male produce sells at an extravagant rate. From half-a-guinea to a guinea is the price paid for letting good bulls; but the poor man, with whom a bull is a bull, goes to the nearest sire, whose services he obtains gratuitously, or for a shilling at the utmost. The number of cattle fattened for the English market is considerable, and many of them attain great weight; and this fact proves that *stall* feeding, green crops, and excellent management among the higher classes of farmers, is also considerably increased. The short-horn breed may be sold perfectly fat at the age of two or two and a-half years. We saw two bullocks of this age, the property of Ambrose Boxwell, Esq., which weighed nearly 10 cwt. each, and sold for L.53 in the Liverpool market. Several of those gentlemen farmers who feed cattle on turnips, in the counties of Wicklow and Wexford, and, indeed, on all those parts of the eastern coast of Ireland, which present immediate intercourse by steam navigation with Liverpool and Bristol, regularly forward their fat cattle to those ports, in preference to the home markets. The average weight of these exported beasts may be rated at 6 cwt. These when fattening have abundance of prime hay, but the general food of store cattle is fresh thrashed oaten or barley straw, unless when near calving. But during last winter and this spring, little or no hay was given to the working horses of the poor Irish farmer, who substituted straw and chopped furze, with the refuse of the potatoes boiled for his own meals. The cattle have, however, been hard worked, though in such bad order for hard labour; several horses and cows have died from bad keeping, and many of the living ones present a miserable appearance. The price of meat has increased with the growing supply, and there is now no reason to apprehend an excess of supply, and consequent failure of remunerating prices.

There is also an improvement in the breed of sheep, though the quality of the meat, from the early age at which the improved breed is slaughtered, is not of high flavour. The Liver-

pool and Bristol markets have unceasing drafts of sheep, as well as of fat cattle, from the Irish ports, and the butcher looks only to *weight* of flesh as compared with bone. The sheep kept by small farmers are generally half starved, and are unquestionably altogether unsuited to very small holdings, unless one or two be house-fed on garden refuse, small potatoes, &c. They are often kept on land requiring drainage, where it is wonderful they do not get the rot, one and all, and yet they often escape surprisingly.

We shall now consider the condition of the *humble cottier* and *labourer*, whom we put first in our programme, but displaced for that more important, though less amiable, personage—the middleman. We shall consider him with relation to *employment, house, food, and con-acre management, and general habits.*

Employment.—This has increased of late years for men and well grown boys, but not for women and girls. An agricultural labourer, unless he be a farm servant fed in the house, and occupied every day, not prohibited by the Roman Catholic Church, loses at least one day in every week besides Sunday. A few farmers employ the wives of their labourers in knitting and spinning, but this work is generally executed by the females of the farmer's own family. Boys of advanced age are employed frequently, and sometimes permanently, in driving horses and herding cows; but children under the age of fourteen are not employed at all for hire. The rate of wages varies from a shilling to sixpence per day without food, and from sixpence to threepence with diet.

In the neighbourhood of towns, and in the provinces of Ulster and Leinster, the labourer has never less than tenpence per day without food; but in parts of Munster and Connaught, he rarely has more than eightpence per day *at the highest.* Women and boys earn from fivepence to threepence per day, but their employment is limited to seasons. Those who work the whole year round receive no additional wages in harvest. In the most favourable circumstances, the labourer does not earn more than L.10 a-year without diet, or L.6 with it. When task-work can be obtained, the labourer works zealously and at extra hours, and will execute in a given time a much greater

quantity of work, than in the ordinary course of daily labour. The sum which the wife or daughter of an industrious labourer could earn in a year, by the rearing and sale of poultry, cannot be rated higher than 12s,—two hatchings of chickens and one of ducks; by the rearing and sale of pigs, 30s. may be averaged. Spinning, as a source of *profitable* employment, can scarcely be calculated at all. Litigation often occurs about the payment of wages between the employer and his labourer; the latter summenses the former to petty sessions, perhaps for one or two disputed days, but more frequently for balance of half-a-year's wages, withheld by the former on account of the non-fulfilment of the term of servitude by the other, who pays 1s. for the summons and the service of it; and it frequently happens that the decision is against the labourer, who therefore forfeits this legal charge, besides losing two or three days from his love of law. If his claim be allowed, he is paid the costs of summons, &c., by the other party, and is allowed for his loss of time while seeking redress, if he has been unfairly treated by his employer. If the delay of payment arises from inability to pay on the part of the former, the labourer, though himself very needy, is usually indulgent; he only applies to sessions when a previous dispute has arisen about the terms of agreement, or amount of wages with his employer. The most terrible counter-statements are often made on oath in these cases, which are frequently excessively trivial; and much of the litigation arises from the neglect of the labourer to keep an account or a tally.

The cottier differs from a small farmer and ordinary labourer; the small farmer is master of his own time and the mode of meeting his rent engagement; the cottier is bound to work at the rate of fourpence or fivepence a-day, with diet, whenever called upon by his employer, who is of a class almost always oppressive and exacting. Latterly, the farmer prefers domestic farm servants, to avoid the disputes and difficulties attending the cottier system, or because he has lost the privilege of subletting. Cottiers are rarely allowed to keep cows; if they be so privileged, it is at the rate of L. 3 or L. 4 for a summer's grass; not one in fifty has this comfort, expensive though it be. It may be given as a general rule, however, that three days' work in the week is the term of the cottier's obligation for house

and cabbage garden. If he does not work out his rent, which rarely occurs, the farmer can eject him from his tenement; this rent is always taken in work. If the cottier works beyond his stipulated number of days, he is, unless there be a contract as to specified wages, allowed the current wages for the extra time. Disputes sometimes arise from the refusal of the cottier to work in *harvest* at prices less than the current ones. In the course of a few years, the class of cottiers will nearly cease to exist.

The annual income of an ordinary labourer, not a farm servant, specifying the usual sources from which he and his family derive any profit, may be thus estimated,

Earnings by daily labour,		L. 10 0 0
Fowls and Eggs,		0 12 0
Profit on pigs,		2 0 0
		L. 12 12 0

Food.

The expenses of Potatoes, if retailed to him,	L. 7 10 0	
Do. Milk, do. do.	1 10 0	
Do. Meat, do. do.	0 6 0	
Do. Bread and Tea, do.	0 5 0	
		L. 9 11 0
Add to this for soap, candles, tobacco, and what is termed kitchen, 1s. per week,		2 12 0
Priest's dues on baptism of a child,		0 2 6
Easter dues,		0 2 6
Clothing,		
Rent,		1 10 0
		L. 13 18 0

The labourer's family, if grown up, will of course earn something, but when the children are numerous, the labourer's condition is very lamentable. We have allowed nothing in the above calculation for relief in sickness, purchase, or wear and tear of furniture, or repairs of the cabin. If we were to add a reasonable sum for these matters, we leave a considerable balance against the labourer. The yearly expenditure of his family on clothes, even if the wife or daughter knit wool and flax and make flannel, must be two or three pounds. Shoes are dear, and are universally worn, unless by very young children in some of the eastern counties. How, then, could the labourer live on his actual wages, without a patch of land on which to

raise potatoes? The whole secret of the matter is, that he procures from a rood to an acre either for his manure, and, in such a case, without any cost or at a rent. Under all the foregoing circumstances, it must appear, that the substitution of bread for potatoes would be impracticable.

House.—In their cabins there is a considerable variety of condition; the best class of which we may venture to call cottages, occupied by small holders or labourers in very comfortable circumstances. The walls of these are generally seven feet in height, of well cemented mud, rough-dashed outside with lime mortar, plastered within, and usually thatched with straw. The interior consists of two apartments, a kitchen, twelve feet square, a sleeping room, twelve feet by eight, with a loft overhead; they have not lath and plaster ceilings, as the thatch is a sufficiently warm protection from the weather. In the houses of the larger working farmers, there is generally a parlour, too often a very dirty one, on one side of the kitchen, with two small bed-rooms within it. All the doors have iron hinges and latches, but the outside one alone has a lock, which is rarely used except when *all* the family are from home or in distant fields; a wooden bolt on the inside is the general defence at night. To houses on this scale, out-offices, proportioned to the size of the farm and the stock, are attached. The appearance of the dresser or cupboard is generally a fair evidence of the circumstances of the family and the habits of the female inmates: if well supplied with earthen and glass wares, good living, or at least, occasional enjoyment of creature comforts, may be inferred; and if these articles be clean and bright, cleanliness and self-respect may justly be attributed to the womankind of the family. Though the little bed-rooms in the better kind of cabins have boarded floors, the bare earth is the ordinary one, and this is not always even level. The chimneys are of brick (hovels have only a hole in the roof), or it may be of sods or wattling. The ordinary size of the windows is twenty four by eighteen inches; these are usually without shutters or curtains, and too frequently fixed in the wall, so that they cannot be opened. Grates are in use wherever coal is used. A small pig-stye with a shed (if there be a cow to occupy it), constitute the out-offices of the mere labourer or holder of two or three acres; but it is a pleasing fact that

there has been a remarkable improvement within late years in the habitations of the peasantry,—their houses are better built, more cleanly and comfortable, and more frequently embellished than formerly; but this subject we have often dwelt upon, and will not now enter on repetition of it. We may, however, notice one or two points which we have no recollection of having noticed on former occasions.

All the materials of these small cabins may be supplied for five pounds, and for one built altogether by the landlord, and with a rood of garden attached, a rent of thirty shillings or two pounds is paid.

If the tenant or cottier builds on a farmer's land, he has sometimes (but rarely) to pay a shilling per foot for the permission. We have known this to have been paid on the reclaimed portion of a common to some previous intruder, in order to secure an undisturbed possession. For any inferior land given to an under-tenant or cottier he is charged at the rate of the best land, and with the disadvantage of having a portion of road measured against him; and is charged L.1 per acre for ploughing, harrowing, making drills (where drills are common, as in Wexford), and covering the seed. Although there are several villages or hamlets in which labouring poor are congregated, the detached houses by the road-side are lamentably numerous, to the great injury of the roads. The isolation of rustic families is, however, favourable to their moral habits and industry.

Food and con-acre management.—The principal food of the labourers and cottiers is potatoes, with milk in summer, and a single herring among an entire family at the dinner meal, by way of condiment. They eat meat about three times in the year, and eggs but rarely, for these are sold to purchase salt and soap. The quantity of potatoes which is requisite for the daily consumption of a labouring man, his wife and three or four young children, may be calculated at three stones. Oatmeal is, in frequent instances, used for breakfast or supper during the summer months, when the old crop becomes bad, and the new is unfit for general use; and happily the longest period intervening between the old crop becoming unfit, and the new crop becoming fit, for human food, does not exceed this short period, during which the distress of the peasantry is always

greatest. The directions of Sir John Sinclair for preserving the surplus of one year against the possible failure of the crop of the succeeding year, is totally disregarded in Ireland. The farina, if used as a substitute for arrow root or tapioca, would be excellent, with a little sugar or salt, for the aged and children, when no milk can be had. With the great mass of the agricultural poor, their food in each year is entirely dependent upon the production of that year, and of course, their distress is always proportioned to the extent of the failure; and since corn, if well stacked and preserved from vermin, will remain good for four or five years, and therefore admits of storing the surplus of abundant years, to supply the possible deficiencies of the succeeding four or five years, the question as to the substitution of corn for potatoes, as preventive of the chances of starvation and disease, arising from the deficiency of the potato crop from different causes, is naturally proposed for consideration.

We will enter a little into the details of the subject. The arguments in favour of corn *versus* potatoes as the general food may be thus briefly stated:—1. One cwt. of meal will support a man for thirty days; the same weight of potatoes will subsist him only for ten. 2. Potatoes are more bulky, and consequently less portable from one district to another; instances have occurred of the peasantry being in a state of starvation in one part of Ireland, while potatoes have been abundant in other parts; and, 3. The cumbrous nature of potatoes obliges the labourer to take con-acre ground (land let out for a crop of potatoes), at a very extravagant rate, in order to have the food at his door, and thus to obviate the necessity and expense of bringing such bulky food from the market, for he cannot run the risk of a contingent or capricious supply from the neighbouring farmers. 4 The litigation and contention between the farmer and labourer when the con-acre is not worth the rent (in which case the labourer often proposes to forfeit seed and labour, in lieu of the rent), or when he is prevented from using any portion of his potatoes until the stipulated rent is paid. 5. Liability to distress, in consequence of a scarcity of potatoes, often creates recklessness of feeling, and produces disturbance, as well as misery and destitution.

Under the foregoing heads may be found all the principal objections against the use of potatoes as the general food of the

Irish peasantry. We must now hear the other side of the question. 1. One cwt. of meal will feed a man, it is true, three times as long as the same weight of potatoes, and this quantity of meal (suppose it oatmeal) will be about double the price of the 3 cwt. of potatoes; but in the first place, the peasants prefer potatoes to meal or even bread, for a constancy—and *de gustibus nil disputandum*—for without any condiment, bread is certainly but an unpalatable food; they can eat potatoes without milk, substituting a little salt fish or pure salt; and on account of the mode in which they obtain potatoes, and the uses to which the waste is applied, this food is decidedly the cheapest, and best suited, in the actual circumstances of this country, to the Irish peasant. He takes either con-acre, in a condition to yield potatoes of average produce at the rate of L.8 per acre, or he has his *garden* as cottier-man. Supposing the first case, the account will stand thus:—

To Rent of one acre of ground, - -	L.8	0	0	By 60 barrels of marketable potatoes at 5s. per barrel, - -	L.15	0	0
... Seed, 8 barrels, at 3s. per barrel, - -	1	4	0	... 10 ditto seed at 3s, -	1	10	0
... Ploughing and harrowing, if spade work be not preferred, - -	1	0	0	... 10 do. for pigs at 2s.	1	0	0
... Labour discharged by the family.							
	L.10	4	0		L.17	10	0

The item of labour, if stipendiary, would, it is true, increase the amount of produce, but it is discharged by the labourer and his family, who would otherwise perhaps be perfectly idle, or it is executed at extra hours, and under such circumstances as take little or nothing from his *pocket*. The case of the cottier man, who, as has been already stated, pays a much less rent, presents a still stronger case in favour of potatoes, if he be able to manure his allotment from his own *midden*. Besides, there is no refuse from meal for the support of a pig or two, the value of which is important in the estimate of a poor man's income. Oatmeal cakes or porridge once a day, in summer, when milk may be had, is desirable; but during the greater portion of the year, dry farinaceous potatoes answer better for any healthy family. Where they can procure *stipendiary labour* for themselves, and all the members of the family are able to labour in

the field, the case is quite different; under such circumstances, we would protest against the con-acre system, and recommend the market for the purchase of potatoes, if sufficiently near, and would recommend the use of some portion of meal.

It *sometimes* happens that the labourer who has taken con-acre ground, is *sued* for the rent or balance of it, although the crop may not be worth it; and very fairly, as the farmer from whom the labourer takes the *quarter-ground* is of course himself bound to pay rent to his landlord, without any stipulation of exemption in consequence of bad seasons or other calamities, the labourer enters voluntarily into a speculation, and should adhere to it, if he can fulfil it. The failure is generally the result of bad management on the part of the temporary occupier; he should therefore bear the consequeences: but considerate farmers, when they can at all afford it, are disposed to make equitable allowances, unless the mismanagement has been very obvious and wilful; and the practice of *suing* for rent is not *usual*, because one half is generally paid in advance, and it rarely occurs that the crop is not worth the other moiety of rent.

The question has been mooted, whether it would be desirable to give the tenant a power of withdrawing from his contract, upon due notice being given to his temporary landlord, in case of manifest failure of the crop; but there would be injustice to the landlord in this case, and the result of such a privilege would be the indisposition of the latter to give the accommodation, which notwithstanding all that has been objected against it, the con-acre system is in many districts calculated to afford.

Nothing proves the importance of the system to the labouring poor in the grazing districts, when employment is unsteady and inadequately remunerated, more than the agrarian outrages in Clare and Limerick, to compel the large farmers to devote portions of their grass lands to its operation; and as a general remark on the subject, it may be assumed, that wherever the con-acre system is prevalent, the peasantry are found to be without any allotments of land attached to their cabins, unemployed, or living at a great distance from market.

We are aware of cases in which, even where employment is abundant, the power of obtaining quarter-ground is highly favourable to the interests of the labourer. On part of the coast

of the county of Wexford, he can obtain land for the crop, from L.2, 10s. to L.4 per acre, without manure; but this he supplies at an easy rate,—sixteen loads of seaweed being sufficient for an acre,—and this he can supply and draw at the cost of L.2. The farmer gives the first ploughing into the bargain, and if he executes the subsequent horse labour of second ploughing and harrowing, drilling and covering the seed, he charges ten shillings per rood.

But to return more directly to the case of potatoes *versus* corn: 2. This objection, that potatoes from their bulk are not portable from one district to another in case of actual distress, does not materially affect the question, as it bears on the general use and preference of the potato. Oats, the poor man's corn crop, have frequently failed when potatoes have been abundant; if the latter fails in any given district, corn is of course substituted *pro tempore*, but (and this strongly manifests the superiority of potatoes as the ordinary food) potatoes are often purchased by the poor man at the rate of 6d. per stone, in preference to meal at a considerably less proportional price. 3. This objection has been already answered in the observation succeeding the calculation of rent paid for con-acre ground and the produce. Where employment is not steady, the only resource of the labourer is quarter-ground, on which he can apply his otherwise idle time. 4. Litigation is usually avoided by paying half the rent in advance in the case of quarter-ground, and the cottier has the power of avoiding dispute with his employer about rent, by keeping a written account, or a *tally*, and settling monthly. 5. As to liability to distress in consequence of the failure of the potato crop, causing recklessness, contention or disturbance, we may justly reply, that failure of the corn crop, and the consequent dearness of bread, have occasioned similar disturbance and popular outrage, from the days of ancient Rome, to modern times, in which the British manufacturers and labourers have kicked up a row.

The sum of what we would convey is this,—that land even at a dear rate, is better for the Irish peasantry than none at all, except where employment is constant and fairly remunerated, and a market is at the door, and that potatoes under the present circumstances of the population are the cheapest food. Bread

is more nutritious and strengthening; this is the strongest argument that can be urged against the advocate for potatoes; but unsuited to the tastes, habits, and peculiarities of the Irish people.

Habits.—We shall conclude this article with a few remarks on the habits of the people. In many parts of Ireland, the laziness and unthriftiness of the peasantry are very obvious, their habitual indolence is traceable to the paralysing nature of their condition: they can only provide a bare subsistence for themselves and families, and being so often thrown on the hire of land for an existence, they are compelled to agree to any terms in order to obtain it; they live on, cottiers it may be, from year to year, unable to retain any of their earnings for the use of their families, without interest in the permanent improvement of their holdings, and being obliged to work out a rack rent by a given number of hours, they have no adequate motive to exert themselves. Thus an indolent mode of labouring becomes their habit; but give them advantageous work to execute, where it is their interest to save time, and they work with great energy; indolence, where the characteristic of any district, has been assuredly engendered by hopelessness. Where the condition of the labourer (or small-holder, who is himself a labourer) is really good, he is an industrious man. Where even a reasonable hope of obtaining the great object of his desire, a bit of good land on reasonable terms, he will undergo labours and difficulties which would appal an Englishman. We are well acquainted with a common labourer in the county of Wexford, who has walked eight miles every working day, to and from the place of his employment, during the last two years, although he might have had work near his own cabin. The *constancy* of the employment (we forget whether at 1s. or 10d. per day), and the *hope* of attracting the notice of the gentleman on whose demesne he labours, and obtaining a house and land with the various advantages enjoyed by the dependents of that proprietor, have supported him in his extra toil. It is no uncommon matter for workmen to travel one or two miles to and from their place of work, six days in the week. Wherever lawless habits and recklessness of life (as we have before remarked on indolence) are characteristic of the labouring classes, it may be concluded that they have

been oppressed, and are hopeless of ever possessing more than a mere subsistence, and so prepared to become the ready agents of mischief, which they sometimes perpetrate *on their own account*, as in the case of forcibly digging up grass lands for potatoes, under the alternative of starvation, but more frequently without being themselves sufferers from the acts of the individual whom they injure; and it has often occurred (as in the case of Lord Devon's property in the county of Limerick, stated in a recent Number), that persons much above the rank of small-holders, have instigated the people to white-boyism, with a view to protect themselves from ejectment. When comfortable in their circumstances, and permanently employed, they are peaceable in themselves, and with difficulty drawn into agrarian disturbances. In proof of this we adduce the following fact. The open part of the common of Mulrancan in the county of Wexford, consisting of about 30 acres, was recently sold by the Commissioners of Woods and Forests to a gentleman who possesses property in its immediate vicinity, and who had previously claimed this piece of land as a portion of his own estate. The peasantry around, who from time to time have enclosed, and with exceeding industry reclaimed, the remainder of the tract of common to which the 30 acres belonged, were for a short time inclined to resist the occupancy of these by the purchaser, and employed some of their women to oppose the progress of inclosure by disturbing the operations of the workmen. But the attendance of a score of the constabulary, and the committal to gaol of half-a-dozen women, caused an immediate cessation of hostilities, and the recognition of Mr ——'s right. The only terms stipulated, or more properly suggested, were, the liberation of the ladies, and the appropriation of an acre or two of this common to the use of a schoolmaster. The peasantry here are *comparatively* very comfortable, and, therefore, disinclined to disorderly conduct of any description. They have made a promise to support the claims of the gentleman referred to, and they will religiously adhere to it.

Imprudence in forming matrimonial connexions is common among the Irish peasantry. This ready compliance with the strong and natural inclination of man with these, often arises

from the feeling that their condition cannot be made worse. Where the young labourers are really comfortable, prudential considerations restrain them from marriage under disadvantageous circumstances: the men usually marry at the age of twenty-five, and the prudent among them look out for fortunes with a girl, from L.10 to L.5; and with this, some furniture is bought, and, generally, a rood of potatoes is planted for the first year's provision. The habit of dram-drinking is carried to a lamentable excess, whenever the means and opportunity present themselves. Yet, considering the privations which they ordinarily undergo, it is surprising that so great a proportion of the Irish poor are of perfectly sober habits. The number of public houses for the sale of whisky is increasing so much as to render the careful superintendence of the police impossible: in some degree the licensing of these is occasioned by political causes. The *liberal* magistrates support every application for a license, because they seek popularity at any risk, and are well aware that each new publican will swear himself a L.10 freeholder from the profits of his ungodly calling. Supposing the average quantity sold in the numerous public houses to be ten gallons a-day, half of this quantity is consumed in drams! Those of most intemperate habits are not to be found in the lowest class of peasantry,—they have not the means nor time for excessive drinking. But many of the farmers, when frequenting fairs and markets, are in the constant habit of returning home in a state of intoxication, and it is a melancholy truth that the habit of drinking is greatest in those districts in which the people are most independent in their general circumstances. The cheapness of a dram is also a powerful temptation to dram drinking, on occasions when the healthful nourishment derivable from a loaf of bread, and beer, cannot be obtained so easily. An equal sum will not procure equal sustenance in any other way; and his habit, first arising perhaps from necessity, comes at length to result in a decided relish for ardent spirits. Tobacco with the poor man is used as a substitute for food; it removes the desire for it, and has now become an indispensable source of enjoyment; the tenth part of his daily wages is frequently consumed by the labourer. Spirits are preferred to beer or ale;

even by the more comfortable farmers, and even women (we speak only of the rural population), who are decidedly of sober habits, and who are hardly ever seen in a state of intoxication, will toss off a dram if presented to them at field labour, or partake of a tumbler of punch at a fair. And who can wonder if these children of toil will, when the rare occasion offers, accept the proffered indulgence? Their physical strength, their habits of labour, render it comparatively harmless to them; they work off the effects immediately, and, on the average of the year, take an incalculably less quantity of alcohol than the females of higher rank who drink wine, strong beer, or it may be punch, every day in the year, without any corresponding degree of bodily exercise. D.

ON THE AGRICULTURE OF HINDOSTAN.—NO. II.

Of flowers, that, with one scarlet gleam
Cover a hundred leagues, and seem
To set the hills on fire. WORDSWORTH.

1. *Rice.*—IN following up our outlinear account of Asiatic husbandry, we come now to the consideration of Rice, the grand staple of Hindoo dietetics. Although Linnæus makes the *fortè habitat* of this grain in Ethiopia, yet he seems to have no sufficient authority to bear him out on this point; and it may be regarded as indigenous alike to Asia and many parts of the African continent. Indeed Miller says with reference to this very point, that, by a curious mistake, the great Swedish botanist has generally put Ethiopia for the country about the Cape of Good Hope, but perhaps may, in this instance, mean by that term to comprehend Abyssinia. As is well known, rice is also cultivated extensively in the southern parts of Europe, and in North America, especially Carolina.

Its antiquity in the East is beyond all record; but in the Western hemisphere, its introduction does not go beyond the beginning of the last century. It is said that a vessel from Madagascar happening to put into Carolina, a parcel of seed-

rice was given by the Captain to a resident; in the course of a few seasons it was general over the province; and from various experiments and observations having been made regarding its culture, a grain was here produced much superior in quality to the original. It is also recorded, that nearly about the same time another small parcel of seed-rice was sent to America by Mr Dubois, the treasurer of the East India Company, and that its cultivation was attended with great success. We are informed that to these two kinds of rice grown in America, the white and the red, owed their origin.

Mr Porter's definition of this grain is at once so succinct and correct, that we cannot do better than quote his words.

> "Rice," he says, "is an annual plant, rising with a round jointed stalk, similar to that of wheat, but the joints are more numerous; its height varies from one to six feet, according to the variety. The leaves are subulate, linear, and reflex; embracing the stalk—they are not unlike those of the leek. The flowers are in a terminating panicle, and are succeeded by single oblong seeds, borne on separate pedicles, which spring from the main stalk of the panicle or ear. The grains are enveloped in rough yellow husks, and from each proceeds an awn or beard; within the husk is a thin pellicle. The whole of the ear more nearly resembles that of oats than any other of the grain-bearing plants grown in England. These seeds, divested of their husk and pellicle, are the rice of commerce. Before they are husked, they are called *Paddy*; or more correctly *Paddie*."*

It were an endless and a useless task to attempt an enumeration of the varieties of rice in cultivation. Heyne enumerates no less than twenty-three kinds, each having a peculiar name and character, grown in the Mysore alone; and Baboo Radhakant Deb, has recently given twenty different varieties of cultivation in as many different districts.† The whole, however, may be classed as varieties only of the four great heads, the *Oriza sativa*, or common rice, which thrives only on marshy soils,—the *Oriza præcox* which also delights in humid situations,—the mountain rice or *Oriza mutica*, which is cultivated in Cochin China, and in Java, and which has its most congenial situation on the slopes of hills—and the *Oriza glutinosa* or gummy rice, which is an intermediate variety between the

* Tropical Agriculturist, p. 172–3.

† Transactions of the Agricultural and Horticultural Society of India, vol. ii p. 193, et seq.

mountain rice and the other two kinds, ripening sooner than some, and later than others, and growing alike on wet and dry soils.

The periods of maturation of course depend much not only on the subvarieties of the plant, but on the soil and climate, and hence the common rice takes according to circumstances from three to even seven months before being properly ripened. Four and a-half months may be considered as the average time, and two crops are expected annually. The rice in its wild state sows itself in the early winter months, vegetates during the season of the early rains,—ripens during that season—and again drops its seed at the approach of wintry weather.

A level surface is essentially necessary for the cultivation of rice, as frequent inundations must be had recourse to. Where this is not the case, the ground is divided into terraces, and to irrigate these, great pains are taken to conduct the waters of the neighbouring springs and rivulets. When the descent is steep, these terraces are often not more than two or three feet wide.

In May the preparation of the rice fields commences; frequent ploughing is had recourse to, where that is practicable, but where it is terraced, only the hand-hoe can be used. Whenever circumstances permit, the ground is previously manured, the produce being thereby rendered not only greater, but of superior quality. The seed is sown in a corner of the field, and the plants remain there, till about a foot high. When the soil has been irrigated sufficiently, so that it can be reduced to mud by the hoe, the time of transplantation begins, and this is generally about the middle of June. The seedlings are then carefully plucked up by the roots and planted out, the field being subsequently laid under three inches of water—which after being allowed to stand for a few days is again drained off, and a fresh inundation resorted to. For accomplishing this transplantation only the finger is used, with which a hole is made, for the reception of the seedling. Vegetation then proceeds rapidly. In Behar such is the prodigal richness of nature, that in two months from planting the rice is ready for the sickle. In August a second crop succeeds, and is reaped in November. "Planting a rice field," says Mr Porter, "is in India a period of jollity and bustle, and the usually inactive Hindoo then dis-

plays an alertness and vivacity, which for a while overcomes the phlegmatic indolence of the race." Mr Tennant in his Indian Recreations, bears also concurrent testimony to the same fact. "This is the grand season of business," he observes, "with the Hindoo farmer, when his concerns absorb those of every other man in the community. He has then a prescriptive right, established by the practice and usage of some thousand years, to call out not only the artists of the village, but their women and children, to his assistance; though the hurry of business should continue a week or two."*

To facilitate the practice of irrigation, so essentially necessary to the successful cultivation of the common rice, the neighbourhood of streams and rivers is generally selected. The only other resources are the construction of artificial tanks, or the drawing of water from wells, a process of great labour. In his Agricultural survey of Bagulkot and Badamy, Dr Marshall observes, that the culture of rice from a tank or reservoir is so distinct a process as to call for a separate description.

"There are," he says, "three of these tanks in this district, the principal is in the vale of Kendow near Badamy, and occupies abont 500 or 600 acres. It maintained its depth of from three to six feet nearly at all seasons, being supplied by perennial springs from the hills which surround it, and nothing short of an absolute failure of rain dries them up. It is closed at its southern end by a mound, but the water is perpetually flowing by three or four channels communicating with its bottom by springs, and what thus escapes is sufficient to inundate a tract of about two miles in length, and one in breadth, which is entirely devoted to the rice culture. The fields are not terraced, but appear to be all on one level; there must, however, be an imperceptible slope, as the water does not ever seem to be absolutely stagnant, but there is always a flow from the tank to the river below. The land is perpetually a plunge of two or three feet deep of mud; in this state it is worked, sown, and weeded, and in this state is the grain reaped. Each man's field is separated from his neighbours, by an embankment of scarcely more than six inches high, and is divided into a number of little rectangles of four or five yards long, and two or three broad, the banks of which are three or four inches high. Two crops are obtained annually, one sown in August the other in February, the latter is reckoned considerably the best, as in the other the ripening grain is exposed to cold weather, which is injurious to its filling. The ground has not more than fifteen days respite between the reaping of one crop and the preparation for the next."†

* Indian Recreations, vol. ii. p. 185.

† Statistical Reports, page 119. Dr Marshall gives the following statement of expenditure and produce from a field of eight Pahilees (that is re-

Where streams are not present, and where tanks are not used, the water for irrigation is sometimes laboriously drawn from wells, by the aid of bullocks, in a manner peculiar to India. In a steep acclivity from the edge of the well, a path is made just sufficient for two bullocks to walk abreast, and this walk is proportioned in length to the depth of the well. A wheel or pulley is placed over the well, fixed to substantial beams of wood, and over the wheel or pulley is placed a rope attached to an iron or leathern bucket, ending at bottom in a conical flexible point. To this another rope is attached and conducted over another pulley, placed considerably below the other. The extremities of both of these ropes being fastened to the bullocks, and the animals made to move in a retrograde direction towards the well, the bucket necessarily descends, and fills itself with water; when they are driven forward again, the bucket of course again ascends to the top. The second rope fastened to the flexible extremity of the bucket, being the shorter of the two, it gradually in ascending becomes tightened, and on reaching the height of the channel, where the water is intended to be discharged, it is thrown over and empties itself. Mr Hamilton in his statistical survey informs us, that if the bullocks are well broken in, one man is capable of managing the whole, and that an eighth of a ton may be raised at once by this simple, yet curious plan.

quiring thirty-two seers of seed) rented by a shopkeeper. The Doctor, however, thinks the account of the profits not much to be depended on.

	Rs.	Qrs.	
Working the mud, ...	3	0	
Dung and carriage, ...	2	0	
Treading in ditto, smoothing and sowing, .	1	2	
Weeding, ...	2	0	
Managing the water and watching the field,	1	2	
Seed, ...	4	2	
	14	2	for one crop.
For the two crops of one year, . .	29	0	
Assessment, ...	19	0	
Rupees,	48	0	

Produce reckoned at 2¼ goonees for each crop, being an increase of about 10 to 1. For the two crops 5 goonees worth this season (1820.)

Rupees,	91	2
Deduct charges,	48	0
Profit,	43	2

The mountain rice is much less expensive in its cultivation, as it neither requires such outlay in preparation of soil or labour in irrigation. In March the land is well hoed and manured, and this operation is for three or four times repeated weekly, and the clods pulverised by a mallet. After the showers of May it is again hoed, and the mould still farther broken down and smoothed over. Drills at a span's distance are then made by the finger, directed by a line, four or five seeds being deposited in every span's length. A small sprinkling of mould is then laid over them. In four or five days the young plants make their appearance, and from the middle of June to the middle of August, the weeding of the ground by means of a spade becomes frequently a very necessary operation. In the moister grounds, especially those of Nepaul, when the plants are about two feet high, the ground comes to be infested with slugs, worms, and other vermin; to destroy which, the farmers turn a number of ducks into the rice-grounds. In the earlier part of September the crop usually ripens, and the harvest is gathered in by the middle of the same month. This is done simply by cutting off the ears, which have the grain beat out of them the day after they are reaped, and thereafter it is dried in the sun.*

The cultivation of rice is considered, under most circumstances, to be a very profitable speculation. The rice-crop of Bengal is considered to be generally better than that of any other part of India, and is estimated at forty bushels per acre. Hamilton estimates the average of Nepaul at only twenty-eight bushels. We are told by Crawfurd,† that in Java an English acre of good land yields annually, besides a green crop, 641 lb. avoirdupois of clean-grained rice; but, on the lighter soils, where two crops are reaped annually, an acre does not average above [illegible] lb. per crop. Even in the rich plains of Lombardy, the average crop per acre is only estimated at forty-eight bushels per acre; and in the Carnatic, where four crops are raised in one year, two on the same ground, we are told by Mr Porter,‡ that the first crop produces fifty-fold, the second forty-fold, the third the same, and the fourth between twenty and thirty fold. Rice in

* Vide Heyne's Statistical Tracts on India.

† Crawfurd's Indian Archipelago.

‡ Tropical Agriculturist, p. [illegible]

Java yields, under favourable circumstances, from twenty-five to thirty-fold; but the produce of the mountain-rice does not exceed half this quantity.*

In June 1836 a report was transmitted to the Agricultural Society of India by Lord Auckland, from the Society of Arts in London, regarding some of the productions sent to the Chairman of the East India Company, for the consideration of that Society; and we find that the first of the opinions given is on the Joomla or Himalaya Paddy or Mountain Rice. It would appear from this document, that parcels of the same seed had been sent to this country in 1821, and were distributed among different districts in England, as well as in France, Switzerland, Germany, and Russia. It is not yet properly known how the Continental trials succeeded, but in England the seed did not germinate. From some of the French journals we also learn, that the seed of the hill rice of Nepaul had been distributed by the government of that country throughout various districts of France, but that the attempt to cultivate it had been unsuccessful.

From the second part of the third volume of the Transactions of the Agricultural and Horticultural Society of India, which has just come to hand, through the extreme kindness and attention of Mr John Bell, the Secretary, we learn that Mr Anderson, the Curator of the Apothecaries' Garden at Chelsea, was one of those who undertook to make an experiment on the possibility of growing the hill-rice in England, and was in consequence furnished with some seeds of the five varieties at that time in the Society's possession. They were sown in March, and some of each kind germinated, and did very well when they were removed to the greenhouse, where they became stout plants. In the end of June they were transferred to a sheltered place in a basin for the growth of aquatic plants, having nine inches depth of water and twelve of mud. Here they grew, and promised well till the beginning of August, when the weather becoming cloudy and rather cold, they grew sickly, and were all dead by the beginning of September, without having come into flower. It seems, therefore, evident, that the temperature, even

* Heyne's Statistical Tracts.

of the warmer parts of England, is not sufficient for the successful cultivation of the hill-rice.

In order to obtain a correct opinion of the comparative value of hill-rice, with the other qualities of this grain in the London market, a sample was sent to Mr Ewbank for examination. This gentleman reported that fine Carolina rice imported in the state of paddy, and cleaned in England, is worth 30s. per cwt.; and that rough and inferior East India rice, imported half cleaned, and finished in England, is worth 14s. per cwt. This latter was purchased from the importer at 8s., lost 20 per cent. in cleaning, and the cost of this process was 2s. per cent. for interest, profit, &c. Mr Ewbank concludes by saying, that the hill-rice is nearly of the same quality as the latter kind, being dark coloured, opake, and not at all calculated for the English market.

The Committee of colonies and trade have therefore given it as their decided opinion, that the hill-rice cannot be successfully cultivated in Europe, and that if capable of being so cultivated, it could not enter into competition in the European market with Bengal rice.*

The separation of the grain from the ear is, in most countries where rice is extensively cultivated, performed by means of a hand-flail; no machine having yet been contrived for the successful performance of this operation. As the husk adheres very tenaciously, it is passed through a pair of millstones, so far separated from each other as to remove the husk without crushing the grain; the pellicle being afterwards disengaged by trituration in large mortars. The rice of India is for home-consumption husked dry, but when intended for exportation it is scalded. Paddy or rice in the husk is now imported into England, in considerable quantities, and a great saving of price is thus made. Not only is there less waste in the transportation, but the rate of duty is much lower, and it is divested of the husk much better by the improved machinery of England than by the rude and simple Indian method. The apparatus for this purpose was invented by Messrs Lucas and Ewbank, who obtained a patent for its exclusive use in the year 1827.†

* Vide Transactions of Agricultural Society of India, vol. iii. part 2d, p. 120.

† For an account of this apparatus, vide Tropical Agriculturist, p. 191–2.

2. *Coffee.*—From the cultivation of rice, let us now pass to the consideration of the coffee-plant,—the infusion of whose berries has become perhaps the most extensively used beverage in the world.

The coffee-tree is pretty generally supposed to have been a native of Arabia. Mr Porter, however, rather leans to the opinion that it came from Ethiopia, where the people had made use of it from immemorial time, and that passing thence to Persia, it was at length carried to Arabia. Its introduction into other parts of the East, and into Europe, comes quite within the scope of authentic history, and is of a date which can be readily accredited. It is a matter of much more difficulty to account for the circumstance of the seed of a berry, the pulp of which is useless, and which is itself, in its natural state, nauseous and ungrateful, having been discovered to be palatable and refreshing when exposed in a certain degree to the action of fire.

The increase of the consumption of coffee in Great Britain has, within the last few years, been so great as to be utterly surprising: having, since the commencement of the present century, advanced from an annual consumption of 240 tons to forty times that quantity.

"The consumption of the kingdom in 1831," says the Tropical Agriculturist,* "reached 9865 tons, or upwards of twenty-two millions of pounds weight. Nor is this increase peculiar to Great Britain alone;—the rapidly augmenting population of the United States of America equally evince a growing taste for coffee, so that the importation of the article into that country has been nearly trebled within the last ten years, and is estimated at this time to amount to 20,000 tons, or rather more than double the quantity upon which the home-consumption duty is paid in this kingdom. The cause of this increase, in both cases, is to be sought primarily and principally in the reductions made by the respective governments of England and America in the rate of duties chargeable on consumption; nor is there reason to suppose that much, if any, falling off in the quantities now used will be experienced in either country, unless upon the re-imposition of heavy duties—a course which it is very little likely will be adopted. If, on the contrary, our present scale of duty is preserved, we may reasonably expect that, as the merits of the beverage become more known to the bulk of our population, its use will be progressively extended, until, as it has long done on the continent of Europe, coffee, in a great measure, takes the place of tea, and comes to be considered among the indispensable wants of the people."

* Pages 52-3.

The coffee-tree, or rather shrub, is an evergreen of rapid growth, and has a reddish fibrous tap-root, which shoots downwards perpendicularly. In Arabia it has been known to grow to a height above thirty feet, but its stem rarely exceeds five inches in girth. In our western colonies it rarely attains a height of more than sixteen or eighteen feet. Its branches stretch out horizontally from opposite sides of the trunk, and are covered with a fine greyish bark. The wood of the coffee-tree is elastic and soft, and the leaf an elongated oval, with a short foot-stalk; indeed, very much resembling the leaves of the common laurel in its bright green, and smooth and glossy surface. They grow in pairs from the branches, and the largest are about two inches wide, and four or five long. From the axillæ of most of them proceed small groups of white blossoms, each formed by a single petal, and resembling the Spanish jasmine. The perfume of these flowers is very agreeable, and when they are in full perfection the tree is one of great grace and beauty; this, however, is of short duration, as they fade in a very few days. A partial flowering lasts during the whole season, but the blossoms are not very numerous or fine, save in the spring and autumn. The crude berry, when first exposed by the falling off of the flower, is of a light green. The clusters are generally so large that only a part of them can possibly be sufficiently exposed to ripen, and consequently it is necessary to gather them at different times. "In its progress to maturity," says Mr Porter, "the fruit grows first white, then yellow, afterwards reddish, then of a bright red, and at length, when fully ripe, the berries are of a very deep red. In this state they so nearly resemble the cherries cultivated in Europe, that if put among the last mentioned fruit, it would require examination both by taste and smell, as well as by the eye, in order to distinguish them."*

A fleshy matter envelopes the seed, and also two thin shells of an oval form. This has been called by planters the parchment, and more immediately encloses the seed, which is of a horneous and hard consistence, and forms the important article of commerce, known as coffee. It is now quite well known that the plant will not come to maturity in any region liable to

* Tropical Agriculturist, p. 59.

frost. Its cultivation must therefore necessarily be confined to the tropical regions, and their immediate confines.

Notwithstanding this, it is worthy of remark, that the coffee plant will thrive in any soil where the roots can penetrate, and that, although very deep and fertile soils may add to the luxuriant foliage of the plant, these are not the best for the quality of its produce. A hillside of eastern exposure is said to be the most favourable situation, especially if soft rains or refreshing dews be also added. When planted in an exposed plain, the rays of the sun are apt to bring the fruit prematurely forward, and hence plantations in front to ward off the rays have been occasionally resorted to. *

In laying out coffee grounds the seeds are sometimes planted in the spots where they are intended to remain, and sometimes the seedlings are transferred from nurseries. On this side of the equator the autumnal equinox is the favourite season for sowing, but beyond the line the vernal is preferred, since thus the plants are not exposed to the strongest heat of the climate, until arrived at a growth sufficient to resist its fierceness. The rows of the seedlings are generally kept about nine feet asunder, as from their luxuriance in a rich soil they are apt to crowd upon each other and hurt their productiveness. The quincunx form is generally adopted in laying out a coffee plantation, and in the richest soils it is customary to keep the rows even twelve feet separate from each other.

The nursery grounds are carefully hand-watered, or irrigation by small channels is adopted. The seeds sown generally come up

* With reference to this plant, as regarding the climate of Jamaica, we cannot do better than quote the succinct account of Dr Brown. He describes the coffee-plant as " a shrub which grows luxuriously, and rises frequently to the height of eight or nine feet, spreading its flexible branches to a considerable distance on every side. It thrives best in a rich soil, and a cool and shaded situation where it is refreshed with a moderate degree of moisture. Under such circumstances it generally produces so great a quantity of fruit that the branches can scarcely sustain the weight, and even the trunk is sometimes seen to yield to the load. The tree will grow and thrive in almost every soil about the mountains of Jamaica, and in even the driest spots has frequently produced very abundant crops. In Arabia, where the drought is frequently excessive, it is usual with the cultivators to refresh the roots of the trees with water, which is conveyed in channels throughout the plantations."—*Natural History of Jamaica.*

in a month, and by nine or ten months are fit for transplantation. This is a very simple process, and consists merely in placing the seedling with a sufficient quantity of soil about its roots in a hole prepared for it, as shortly after removing it from its original situation as can possibly be done.

At the end of two years the coffee trees begin to be productive if they have been properly tended, and the ground near them kept free from weeds. At four years they are at full bearing, and continue so for fifteen or twenty. Old trees blossom less than the young, but their fruit is reckoned of superior flavour and quality. The ripening of the coffee is known by the leaves becoming of a deep brownish-red.

In Arabia as well as the West Indies the coffee crop is gathered in at three separate periods. In the former region the ripe cherries are shook down, in the latter they are gathered by the hand. This harvest seldom begins till the middle of July, and generally extends through August and part of September. The greater part of the crop is secured by the end of October, although so late as November some pickings may occasionally be found.

When the berries are gathered the first care is the proper drying of them, and the separation of the beans from the pulp. This is accomplished by exposure on an inclined plane or terrace, covered with cement, for several days to the air and rays of the sun. A stove is sometimes used, and that method is said by some planters to possess several advantages, as it can be had recourse to in all weather, and there is no risk of fermentation, while there is economy of labour. In other cases a mill has been used for separating the pulp from the seed. It is composed of two wooden cylinders, each about twelve inches diameter, covered with sheet copper, so roughened on the surface as to act like a grater. A hopper is placed above these, into which the berries are thrown. The separation is thus readily effected, both husks and beans falling upon an inclined wire-sieve, down which the latter run and are received in baskets at the bottom, the dry and broken husks passing between the wires. The beans are now immersed in water, and allowed to remain there till next day, the adherent gum being thus softened preparatory to washing. Wooden troughs are gene-

rally used for this last purpose, and in these the beans are stirred about. The lighter and useless ones swim on the surface, and are removed by skimming.

The drying of the coffee is the next process, and this is done on an inclined platform either of smooth tiles or cement exposed to the rays of the sun, and in three or four days, if the weather be fine, the purpose is perfectly accomplished. The coffee is then laid up for some time in store, care being taken that it is not heaped too thickly together, and that it be turned over two or three times daily. In Arabia the coffee is kept for more than a year exposed to the air, but sheltered from the sun and damp, and constantly turned over. It is not till after the lapse of this period that the pellicle or parchment cover is removed. The literary reader will remember the beautiful evening scene in the tent of the Arabian family, immortalized in Southey's Thalaba.

> "Comfort is within,
> The embers' cheerful glow,
> The sound of the familiar voice,
> The song that lightens toil.
> Under the common shelter on dry sand
> The quiet camels ruminate their food;
> From Moath falls the lengthening cord
> As patiently the old man
> Intwines the strong palm-fibres; *by the hearth*
> *The damsel shakes the coffee-grains,*
> *That with warm fragrance fill the tent.*
> And while with dextrous fingers Thalaba
> Shapes the green basket, haply at his feet
> Her favourite kidling gnaws the twig,
> Forgiven plunderer for Oneiza's sake."

To divest the beans of this parchment is no easy process, and requires that up to the time of its commencement they should be in a heated and very dry state. A solid wheel of hard wood six or eight feet in diameter, and ten or twelve inches thick, is used for this purpose, and is made to work in a circular trough by means of an axis passing through its centre, one end of which is fastened by an iron ring to the centre-post of the mill, while to the other projecting over the mill-course a horse is harnessed, and the wheel is thus carried round. It is thence conveyed to a fanning-mill, in order that any of the adhering

particles of parchment may thus be removed. When thoroughly cleaned it is again exposed for some days to the beams of the sun, it is then carefully hand-picked, and becomes a marketable commodity.

The virtues of coffee as an article of food consist in its refreshing qualities, which produce exhilaration of the spirits. A strong decoction occasions temporary watchfulness, followed by profound yet pleasant sleep. The irregularity of the production of these effects from the use of coffee is attributed by Professor Dunovan of Dublin, who has made many curious and useful experiments on the subject, to the imperfect manner in which the berries are very generally prepared.* The exhilarating quality he thinks the only inherent one in coffee; the narcotic one he attributes to the roasting process.

Mr Richardson Porter is quite of opinion that the inferiority of West India coffee to that of Arabia is not referable to soil and climate, but to the superior judgment in the cultivation of the latter, and the superior skill in the preparation of the produce. Good plantation coffee, if kept for a few years in a dry situation, improves in a wonderful degree, and acquires a flavour equal to the best from the East. If the original store be good, five or six years will suffice for this purpose.

The importation of coffee into the United Kingdom, in 1831, was as follows:

From the British Plantations, ...	20,116,381 lbs.
East Indies, ...	7,686,500
Foreign, ...	15,204,947

The net revenue derived from the same being L.583,751.

In his recently published account of the soil and agriculture of Penang, Captain Low says, that in that climate, "the plant thrives luxuriantly on the plains in the shade, and on the hills without the shade;" and that the quality of the produce now obtained is considered equal to the average of that taken to the European market, from any other regions excepting Mocha.†

* See Dublin Philosophical Journal, May 1826.

† *Vide* Dissertation on the Soil and Agriculture of the British Settlement of Penang in the Straits of Malacca, &c., by Captain James Low of the Madras Army, Corresponding Member of the Royal Asiatic Society, &c. Singapore Free Press, 1836. This is a work of very considerable merit and research

3. *Maize.*—The Zea Mays, or as it has been called in this country, Indian corn, from its having been found in cultivation among the Mexicans at the discovery of that region of America by the Europeans, is a large article of eastern produce also. There can, therefore, be little doubt that the grain is indigenous to both hemispheres.

Maize is an annual plant, and its characteristics are a jointed stalk, with large alternate leaves resembling flags. The stalk is overtopped by a loose bunch of the male flowers of various colours, called the tassel of the plant. The female flowers are situated below the male, and are disposed in thick spikes. The ear consists of a cylindrical substance which is called the cobb, from the centre of which radial stems issue. To these the germs of the seed are attached, as are also thin delicate husks, united in pairs to each other. In these the seeds are imbedded in separate compartments. There are generally twelve rows of grains, each containing from twenty-five to thirty-five seeds. The thin pale green filaments coming from each of these grains on their formation, and issuing out in threads at the top of the husk, have been termed the silk of the plant. The general tinge of the seeds is white or yellow, but on the same head they may be found of various colours, red, blue, green, and black. Linnæus makes only one species of this plant, Miller three. The late Mr Cobbett, as good an authority on this subject as either, in writing of its varieties, says, " they are as numerous as the sorts of wheat, of which we know thirty or forty."* In fact, it is enough to say that there is the late and the early, the yellow and the white, and that these varieties may be indefinitely modified by soil and climate. It will thrive in much poorer soils than wheat, or even oats, rye, or barley. The same extraordinary writer remarks, that he

" Has seen it grown in America, in fields which would have borne neither of these; and this in thousands and thousands of instances. It is regarded as what we call *a fallow crop*, as well as a productive crop. I have seen fields which have lain several years without producing any thing but a little miserable grass, liberally mixed with red sorrel and other weeds, which will live when all other plants will perish. I repeat, that any land which will bear a crop of grain of any sort, even an inferior crop of grain, will be made to carry a tolerably good crop of Indian corn."†

* Cobbett on Indian Corn.

† *Ibidem*, cap. iii. par. 34.

Maize is generally sown early in May, and the ground is marked out for that purpose. This is done by a horse drawing a beam of wood behind it in a straight line, so as to make a deep indentation, another is made parallely, four feet distant, until the whole ground is thus gone over. These lines are then intersected at right angles, thus forming the whole field into little squares. At every point of intersection, a small quantity of well prepared manure is deposited. These little heaps are then smoothed by the hoe, and four or five grains deposited in each. About an inch deep of earth is then sprinkled over, and the whole pressed down with the foot. The stirring of the soil during the growth of the plant, is exceedingly useful to its productiveness. From the earliest growth of the maize, weeding by means of the hand-hoe becomes indispensably necessary.

When the male flowers have performed their office, the leaves and the top of the plant are taken off, and the ears thus, from freer exposure, come to earlier maturity. This is done by means of a sharp knife, and when well dried these tops become excellent fodder for cattle.

The whitening of the husks and the hardening of the grains indicate the approach of harvest. In Java maize with a smaller grain ripens in five months, while the larger grain takes seven. In the West India Islands, on the contrary, it has been known to attain a height of fourteen feet, and to ripen in forty days. The ears are stripped off with the footstalks attached, and immediately conveyed to the barn. It is immaterial when the husking process commences, and it is so simple that it can be done by children. It is then preserved in little granaries or bins, standing on a stone floor.

The stubble, or rather the stalks which have been left standing in the fields, make excellent fodder for cattle, and are seldom cut down till November. The husks are used in America for bed stuffing, for which purpose they are excellently adapted, being fine, elastic, durable, and nearly as soft as silk.

One great virtue appertaining to maize is the circumstance of its not being subject to blight, rust, or mildew, and it can withstand the impetuosity of any rains. Another is the immensity of its produce, being greater than that of any other grain. "From one single stalk," says Mr Porter, "on a farm in Bed-

ford, seven ears of corn have been gathered, the whole containing 2077 grains; and it is not uncommon to meet with ears, each of which contains from 500 to 600 grains;" and Mr Crawfurd informs us, that, "in the province of Kader, in Java, 400 or 500 fold is not an unfrequent return; 100 is a fair average, on the poorest lands, and with the most indifferent culture." The celebrated Dr Franklin, who was a great advocate for the culture of this grain, mentions, in summing up its virtues, that,

"The stalks, pressed like sugar-cane, yield a sweet juice, which being fermented and distilled, yields an excellent spirit; boiled without fermentation, it affords a pleasant syrup. In Mexico, fields are sown thick at first, that multitudes of small stalks may arise, which being cut from time to time, like asparagus, are served in desserts, and thin sweet juice extracted in the mouth by chewing them. The meal wetted is excellent food for young, and the old grain for grown fowls."*

In the province of Behar, the rotation of crops on high lands is as follows:—First year, fallow and wheat; Second year, Muckai or Indian corn for first crop, sown in June and reaped in September. This is succeeded by barley of that kind called bigg in England, and bear in Scotland. In the third year Murwa, Sama, or Millet sown in June, with onar or cotton for a second crop. When the field is poor, they sow but one crop of the small Janeira in the beginning of August, which is reaped in December, and then lies fallow again.†

Our remarks on silk, tobacco, tea, indigo, and the other roots, grains, spices, and drugs, whose cultivation engages the attention of the Hindoo farmer, must necessarily be reserved for next number.

THOUGHTS ON DRAINING, AS THE SUREST METHOD OF IMPARTING TO THE SOIL THE BENEFITS OF FERTILITY.

At the conclusion of our last thoughts on draining (vol. vii. p. 533.) is expressed a sentiment which cannot be too emphatically impressed on the minds both of landlords and tenants, that

* Franklin's Works, vol. ii. p. 276–78, 4to Ed. 1818.

† *Vide* Gibbon's State of Agriculture in Behar. Transactions of the Horticultural Society of India, vol. ii.

draining is the first step towards the improvement of the soil, which, if neglected, and the soil permitted to remain, not only in its natural, but in a half cultivated state, all other means of fertilizing it will only prove comparatively abortive in their application. Were draining thoroughly effected, all the present undrained but improvable soil of the country would be rendered *capable* of receiving all the benefits derivable from numerous indirect modes of fertilizing it. These various modes of fertilizing soil, were enumerated to be ploughing, dung, lime, and bone-dust, and these subjects were recommended as interesting topics of enquiry for another paper. It is our purpose now to prosecute that enquiry.

1*st*, *Ploughing*.—In ploughing undrained land, particularly land resting on a wet subsoil, the attention of the ploughman is constantly exercised, otherwise the plough may be thrown out at one place, and dip deeper at another, without any apparent cause for the diversity of its action. There is, however, a paramount cause for it. The texture of soil, however homogeneous it may appear at the surface, greatly varies where the soil rests on a *wet* subsoil, in being consolidated at one place, and loose at another; and of course in being hard and soft at different places. The hard portions become dry by the expulsion of water by the compression of the soil, and the porous portions remain constant receptacles of superfluous water. Small stones become firmly imbedded in the hard portions of the soil, and are loose and apt to be pushed before the plough in the soft portions. The plough, through these alternate changes of hard and soft, wet and dry, portions of the soil, requires the utmost attention in its guidance; the hand and the eye of the ploughman being constantly in requisition, during the operation, to prevent the plough being thrown out or burying itself. But even with attention, such ploughing is unequally executed, and therefore unsatisfactory; whilst the disagreeable nature of the work tends to fatigue the body, and irritate the mind of the ploughman, and the unsteady draught occasioned by the unequal state of the soil, jades the horses more severely than the extent of the work performed. Great discomfort, both to men and horses, attends ploughing soil in such a state, in winter, and it is only less irksome than the danger which both run of injuring their

health. Ague and consumption affect the men, whilst cholic and inflammation of the bowels not unfrequently cut short the existence of the horse. That this is no exaggerated result can be attested by all farmers of wet laud. But the evils of wet land are not confined to the annoyance of men and horses, they obviously affect the state of the cultivated soil, the nature of work, and the condition of crops. With regard to wetness affecting the state of cultivated soil, whatever labour and manure may be bestowed upon it, it always seems poor, hungry, weeping, and is apt to become foul with the strong ramifications of semi-aquatic plants, threading themselves in all directions through it. Being inelastic, its surface is easily permanently imprinted with the hoofs of animals, and consequently, easily poached. Of the nature of the work on soil, in that condition, the furrow-slice in breaking up lea, is not easily laid over with the ear of the mouldboard, its under edge adhering tenaciously to the subsoil, the vegetable matter in the soil becoming, in fact, a kind of incipient peat. When the furrow slice cannot be easily laid over, the slices never clap close together. The harrows rather make scratches over the furrow slices than cut them in pieces and blend them together, and the roller compresses such land so as to deprive the sown crops of the power of spreading their roots in it. As to the effects of wet land on crops, they consist of stinted growth of straw, or should a flush of vegetation be at any time encouraged by the state of the weather, the grain in both cases is lean, thick-skinned, and light. The grass too is short, wiry, and inclined to acidity, instead of being mucilaginous and saccharine in quality and taste, or rather the finer grasses disappear and coarse semi-aquatic kinds occupy their places.

Thoroughly drained land, on the other hand, can be easily worked with all the common implements. Being all alike dry, its texture becomes uniform; and being so, the plough passes through it with an uniform freedom; and where ordinary-sized stones obstruct its course, the plough can easily dislodge them. The plough by its own gravity tends to raise a deep furrow, and the furrow on its part, though heavy, crumbles down and yields to the pressure of the mould-board, forming a friable, mellow, rich looking mould, not unlike the granular texture of raw sugar. The harrows, instead of being held back and start-

ing forward, swim smoothly along, raking the soil into a smooth uniform surface, entirely obliterating the prints of footmarks. The roller compresses the surface of the soil, and leaves what is below it in a soft state for the expansion of the roots of plants. All implements are much easier drawn, and held or driven on drained land; and hence all the operations on it can be executed less laboriously, and, of course, more economically and satisfactorily than on undrained. Much has of late been said of deep-ploughing in connexion with drained land. Deep-ploughing we conceive to be a safe practice under every circumstance. It acts as draining to wet land, which of course must be very temporary in its effects. Its efficacy can only be fully developed on land that has been drained. There it forms one indispensable supplement to draining. It opens an easy access for light and air to the roots of plants, and facilitates their combined beneficial influences on the ingredients in the soil which go to support vegetation. These are all natural consequences of deep-ploughing in the ordinary state of land, but these consequences will only be permanently observed and felt on thoroughly drained land. It matters not in what manner the soil is deeply stirred, the benefits of it will be derived in any case. The common plough with four horses, or a plough made little stronger for the purpose, will stir the soil that is *thoroughly* drained, deep enough for the rumination of the roots of all plants raised in agriculture. Such a plough is equally efficient as any subsoil plough. A soil thus stirred one foot in depth will afford sufficient scope for the roots of most cultivated plants, and even fusiform roots will penetrate beyond that depth in a subsoil that has been thoroughly drained. It matters little, we conceive, whether a drained subsoil is brought up by the plough or no. We are sure it can do no harm when brought up, for it can be made the medium of conveying nourishment to plants as well as the upper soil. Both may be blended together for the common object, and, in a short time, neither can be distinguished from the other. By this property of drained land, we anticipate a general and increased improvement in soil, such an expansion, in short, of its capabilities as to yield more abundant crops with the ordinary quantum of labour and manure.

2. *Dung.*—The baneful effects of undrained land on farm-yard or other matter commonly called manure, are most obvious.

The perceptible dampness in undrained soil, dissolves the soluble portion of farm-yard manure, which, by its gravity, descends beyond the reach of the rootlets of young plants; whilst the strawy portion remains undecomposed for a length of time. This statement may account for the invariable languid vegetation of plants while young in undrained land. After the straw has been decomposed, and vegetation been forced by the advancement of the season, the plants derive nourishment not only from the decomposed straw, but probably also from the soluble matter which had previously descended through the damp soil. Vegetation is thus promoted in summer, but it is generally too late for that season to foster the plants to full maturity. The lateness and immaturity of crops on wet land may thus be explained. The fact is, wet land cannot be put in heart with manure to a sufficient degree to force vegetation without the assistance of the season. These effects on manure will be similar, whether the manure has been applied broadcast or in drills; but as the drill system deposites manure in larger masses on the same extent of ground, the effects will always be found to be comparatively less prejudicial to drilled than to broadcast crops. As an instance in point, potatoes cannot be successfully raised on wet land, when the manure is spread broadcast on the ground in autumn or early in spring. Before such practice can succeed, the land must be in heart. But even in drills, on wet land, the manure will be decomposed in different degrees and at different times. The driest portion of the soil will first and most effectually decompose the manure, the hardest next in degree and time, and the wettest will retain it in a state of maceration, as long as the water is unevaporated by drought. Besides manure remaining inert in wet land, it also remains inert in such land rendered dry by drought. In that predicament the manure becomes desiccated, undecomposed, and easily separated from the soil, which becomes like a steril powder; and remains so until the return of rain. Were the rain to fall in moderate quantities, the decomposition of the manure would be rapidly hastened in the warm soil, but if in inordinate quantities, its decomposition would be retarded as effectually as by the drought, although in this case it would be dissipated before decomposition. Nothing can so convincingly prove the

benefits of draining in immediately securing the fertility of manure to the soil, than in contemplating the baneful effects of too much drought or moisture on manure. And to render the proof the stronger, we have only to contrast these effects with the effect of drained land on manure. The moment that manure is deposited in a proper state, that is in a state of humidity in drained land, its juices are absorbed by the dry soil, and retained there as in a wet sponge half squeezed. The strawy portion being thus deprived of moisture by absorption, and still surrounded with comparatively dry soil, which retains heat within itself, and readily absorbs more from the air, it is readily decomposed, and soon becomes intimately blended with the soil. Food in a semi-moist state is thus placed near and ready prepared for the tender spongioles of plants to exist upon; and supposing the weather no better but only equal to that we have supposed in the case of the manure deposited in undrained land, the progress of vegetation will completely outstrip that in the latter.

3. *Lime.*—Many farmers consider lime a manure, and talk of it as such, but it cannot be a manure, that is, food for plants, in the caustic state in which it is desired to be applied to land, however it may be changed in its nature by admixture with the soil or exposure to the air. Caustic lime would soon destroy vegetable life. Instead of itself being a manure, it rather converts other substances into manure which would otherwise have remained in an inert state. It acts on vegetable matter on all soils, and, by decomposition, renders that matter fit food for plants. This is its chemical mode of action. It also acts mechanically, by separating the particles of adhesive soils by desiccation; but it is not probable that it acts chemically on the earthy portions of any soil. Confounding these properties of the action of lime, when applied to soil, with one another, might lead us to form erroneous conclusions regarding them. When, for instance, we observe lime to act with effect on vegetable matter lying inert in soils, we might conclude that it would be applied with best effect to wet land, in which vegetable matter is most abundantly found to be inert. When lime is found to pulverize and to dry clay soil become hard and cloddy with moisture, we might conclude that wet clays would derive most benefit from lime. Both these conclusions would be decidedly erroneous. Because,

although lime readily decomposes vegetable matter in soil, it only decomposes it advantageously in dry soil, or soil rendered dry by draining, the moisture in wet land rendering the lime effete before it has time to act chemically on the vegetable matter in the soil; and lime only acts beneficially on drained soil, that contains excess of vegetable matter. Many dry soils, and particularly wet soils when drained, contain excess of vegetable matter, which matter, although encouraging a flush of vegetation, is deficient of silica to harden the straw and fill the grain. Caustic lime converts a portion of this soft vegetable matter into silica, whilst it converts another portion of it into a pabulum, by which vegetation is powerfully supported. In like manner, the application of lime to wet clays would be to convert them into mortar, which would harden the soil in drought that was intended to be pulverized. Even in the case of top-dressing grass with lime, which is excellent practice when performed aright, pasture in a constantly swampy state can derive no benefit from it. Before the application of lime therefore, in any circumstances, land should be thoroughly drained.

4. *Bone-dust.*—The extraordinary power of crushed bones, when mixed with the soil, to promote vegetation, has not yet been satisfactorily explained. The finer the bone-dust, and the more intimately it is mixed with the soil, the more active is the vegetation. That the bone is chemically decomposed in its union with the soil is obvious. Lift up a handful of earth in which bone-dust has been mixed for some days, and it will be found to be saturated with a rich oily substance, which makes the earth adhere together into a ball when squeezed in the hand; and this effect will be observed although the bones should have been boiled previously to being crushed into dust. It is hardly conceivable, *a priori*, that so small a quantity of any substance, as of the bone-dust when used, should be able to produce so sensible a change on the soil immediately in contact with it. We cannot positively assert which of the ingredients of the bone-dust it is that constitutes the food of plants, for although the circumstance of boiled crushed bones being as good manure as those in a raw state, would support the belief that it is not the oily matter in bone which constitutes the manure, yet the fact that boiled crushed bones render the soil apparently as rich with oil as raw,

forbids us from asserting that the phosphate of lime alone constitutes the food of plants in bones. But whatever the chemical action of bone-dust on soil may be, we can assert with confidence, that bone-dust will impart no richness to any kind of soil, unless the soil is either naturally dry, or has been drained; and when soil does require draining, the more thoroughly it is drained, the greater effect will bone-dust have upon it as a manure.

We thus see, that unless land be thoroughly drained, all the adventitious substances which are employed to render it fertile, cannot impart their fullest benefits to it. Since this is the case, it is lamentable to think what vast quantities of manure, which take much time to collect, and much money to purchase, is yearly wasted on undrained land! How much more produce might not these quantities of manure annually raise, were they applied to land rendered fit to receive them by thorough draining!

ON THE PREPARATION OF ORCHARDS.

By Mr Towers, C. M. H. S.

I am not aware that I can propose a subject more worthy of the attention of the occupiers of small farms, than that of orchards. It is true, that in consequence of the extensive importation of French apples, we, of the south at least, find a proportionate diminution in the price of our fruit, and therefore can no longer talk of the enormous pecuniary profits which may be realized by its actual sale. But there are other points worthy of consideration, and one of these is the manufacture of cider and perry, which I assert, can be produced, and of excellent quality too, in any country, or district where apples and pears can be grown; of this, I hope, in the succeeding number to afford experimental proof, and, therefore, shall restrict my present remarks to the production of the fruit in the shortest possible time. Apples and pears are, in every way desirable articles in the domestic economy of a family; they are readily obtained, are profitable to a greater or less extent, even at the present low prices, and the culture of the trees is susceptible of much improvement, in a way which can scarcely fail to become a source of much rational enjoyment and satisfaction.

Some years since, an article appeared in the British Farmer's Magazine, (May 1831, I believe,) wherein the writer, Mr Reid of Lancashire, proposed to plant an acre of land with trees, which were to stand five and a-half yards apart, and eleven feet, tree from tree, in the row. The number would be two hundred and forty, and the varieties recommended were—120 Hawthorndens, 20 Keswick codlins, 20 nonsuch, 20 Farnes pippins, 20 French crabs, or Easter apples, 20 Ribston pippins, 20 scarlet nonpareils. The cost of preparation was estimated, including the trees, at about L. 12; and a table of returns, from a plantation of ten acres, was arranged in the fourth year after planting, exhibiting a return of L. 412. The Hawthornden appears to have been extraordinarily prolific; and the following quotation will tend to confirm the fact:—"I believe that L. 300 out of L. 360, received for apples in 1827, was for Hawthorndens; the remainder was received for gooseberries and currants. A piece of ground containing rather less than an acre, which was occupied exclusively by Hawthorndens, produced L. 80, besides growing an excellent crop of potatoes, followed by turnips." The average price of the apples was stated to be only 4s. 6d. per bushel.

We can, however, no longer expect to realise that sum for apples of ordinary character; the fruiterers have of late years been very shy purchasers, and have offered eighteen pence, or even one shilling per bushel, for good kitchen apples, prices which can scarcely have the chance of remunerating profits. We must, therefore, endeavour to change our plan of operation, and thereby improve the value of the fruit in reference to local objects. Indiscriminate planting is a great error; because, it is quite certain that certain sorts of apple trees will not succeed in all soils and climates; and, therefore, the chief consideration to be kept in view, is the quality of the tree, which, in particular situations, soils, or districts, are known experimentally to produce the greatest quantity of really good fruit. The old nonpareil, for instance, continues to be one of the most esteemed of apples, and after Christmas, even in the present depressed state of the fruit-market, commands a very high price: but the tree is, in many countries, not only a shy bearer, but can with difficulty be kept alive. One of the best general gardeners

whom I am acquainted with, at a situation not three miles remote from my residence, cannot obtain a crop of nonpareils; the trees dwindle and refuse to bear. I, at the grafting season of 1836, put a little twig of this variety upon an inactive Hawthornden, and upon one or two other stocks, and obtained fine vigorous shoots, more than eighteen inches in length, notwithstanding the parching drought of the summer.

One of the strongest growing trees of real value, appears to be the Ribston, or Formosa pippin; its foliage is large and bold, and its fruit of a size rather above the medium; it is thus described in *Lindley's Guide to the Orchard, &c.*, p. 80, No. 155.

"*Fruit*, middle-sized, somewhat irregularly formed, with fair, broad, obtuse, indistinct angles in its edges, and generally more broad than long; about two inches and three quarters in diameter, and two inches and a quarter deep. *Eye*, rather small, with a closed calyx, placed in an irregularly angular basin. *Stalk*, half an inch long, slender, inserted in a rather narrow, funnel-shaped cavity, seldom protruding beyond the base. *Skin*, pale yellow, russetty in the crown, and round the stalk, and mottled thinly with dull red on the sunny side. *Flesh*, pale yellow, firm, crisp. *Juice*, saccharine, with a pungent, rich, and delicious aromatic flavour. A dessert apple from October to April, but it is generally in its greatest perfection when it has been gathered a month or six weeks."

It appears that the demand for the tree is very great, and therefore, as well as from observation, I conclude that it succeeds almost in every country.

From the list of winter apples recommended by Mr Lindley, as adapted to the south of Scotland, the four varieties which possess pre-eminent merit are, the old nonpareil, the Ribston pippin, royal pearmain, and scarlet nonpareil. He has omitted the Easter pippin, too often called the French crab, although in his description (p. 46, No. 83,) he says, "It is a most valuable fruit, of great specific gravity, (alluding to the expressed juice) a most hardy tree, an abundant bearer, and keeps longer than any other apple I have ever met with. I had some perfectly sound, and very firm fruit of it in March 1822, which were grown in 1820; the colour then was that of a pale orange."

This apple when unripe, and even as I have seen it in April, is green, intensely hard, sour, and wholly unfit to be eaten; it gradually becomes mellow; and in June and July it becomes really fit for the dessert. I think it one of the best apples for the cider maker, and for all culinary purposes, as it bakes or

roasts very well. This fruit, and the Ribston, would perhaps blend extremely well in the preparation of cider; the fine flavour of the latter being aided by the austerity of the former; for it is acknowledged that, as in wine-making, the finest fruits for the table, are by no means the most suitable to the press. I have heard that the Easter pippin is fruitful in alternate seasons only, but have not witnessed the fact; but where do we meet with apple-trees of any description which carry abundant crops every year?

Of Winter Pears.—Mr Lindley mentions one dozen of the finest varieties, including the Beurré d'Aremberg, Beurré Rance, passe Colmar, glout morceau, &c., as adapted to the climate of Scotland; but I conceive, that the new varieties raised by Thomas A. Knight, Esq., by cross impregnation of some of the richest and most esteemed pears, with the hardy swan's-egg, would be found a real acquisition to Scotland. These trees frequently bear fruit at two or three years from the graft, do not require a wall, and succeed as dwarf standards. As I intend to devote this article to the cultivation of dwarfs, I shall give a list of the pears alluded to, copied from a paper containing the character of the choicest kinds, sent to me by the president himself.

Mr Knight's Hardy Pear-Trees.

1. *The Monarch.*—Musky in a high degree, excessively rich and sweet. Tree very thorny, too luxuriant perhaps for the garden, but particularly suitable to the orchard. *Season* of the fruit, December and January.

2. *The Belmont.*—Excellent, melting, and extremely rich; the tree bears when very young, even in the second year after being grafted; colour of the flesh yellow; skin very russet. *Season*—November.

3. *Garnon's pear.*—Very fine, fruit large, weighing 1 lb. when grown on a wall, rich and melting; but it succeeds and bears freely as a standard. *Season*—October, November, and December.

4. *Althorp Crassanne.*—Fruit rich and melting, but not musky; tree thorny. *Season*—November.

5. *Winter Crassanne.*—Very large and excellent, judged by the Committee of the Horticultural Society to be the best of the varieties. *Season*—January.

6. *Rouse Leuch.*—Tree very productive, and apt to overbear itself; fruit large, and fine. *Season*—January.

7. *The Downton.*—Tree a free grower and very productive; fruit small, but rich, and of fine flavour, and keeps long. *Season*—February.

There are several other varieties, the particular descriptions of which I do not possess. The above, or most of them, were described, and the fruit figured in the Horticultural Transactions of 1830.

The grafts succeed perfectly on very small *quince* stocks; this I have proved, and several trees have produced in the second and third years, blossom buds being abundantly developed on little dwarf standards, scarcely three or four feet high.

I do not wish to dictate to the judgment or practice of any one, but the method which I have invariably found to be most successful, and therefore recommend (to amateurs at least) is *that* known by the terms *crown grafting*, and grafting in the rind or bark. Small stocks of the quince, for pears; and of the Siberian crab (seedlings) for *apples*, from half an inch to an inch in diameter, will be so completely covered by the enlargement of very slender scions, as to leave the junctions scarcely discernible. Mr Knight favours the "*saddle graft*" as presenting broader surfaces to the amputated and prepared stocks; but facility, when consistent with almost certain success, is to me a paramount consideration. I cut the stock down to within three or four inches of the ground, at any time after the middle of March to the end of April, choosing mild and showery weather, and assuming as my criterion, the free yielding of the bark. The scions or grafts are the young wood of the last spring, and rarely exceed the size of a thin goose quill. One or two incisions are made in the bark of the stock perpendicularly downward an inch, or an inch and a half long; a slanting cut is then made in the scion so as to remove a portion of the wood of a corresponding length, and to leave less than half of it remaining, and *that* verging to a point at the bottom. An instrument of bone, termed by some "a messenger," is passed between the bark and wood

of the stock to make way for the scion, and if the bark rise freely, without tearing, the cut end of the scion is immediately pressed into the space opened by the tool. Care is taken that the tool be somewhat less than the part cut by the knife; so that some degree of force must be exerted in thrusting the scion into its channel, till the shoulder reach and rest upon the bark of the stock; for the first principle upon which success depends, is the perfect contact of the wounded surface of the scion with that part of the alburnum of the stock, which is laid bare by the instrument let down between the wood and bark. The juices of the stock are in motion at the season, and in the state of weather to which I have alluded; and those of the graft are in a condition to be stimulated by the vital principle of the stock. One or two scions, according to the size of the stock, being inserted, a string of wetted bass-matting, twisted into the shape of pack-thread, is passed cautiously round the stock, so as rather forcibly to confine the graft to the extent of the part let in; but not so tightly as to force out the juice of the bark. A mass of well wrought grafting clay is then pressed around the ligature, and over the *crown*, so as to conceal and protect the wounded parts. It is wetted and worked with the fingers till it become smooth, and of a long oval figure; and then is finally secured with a piece of moistened flat bass passed over every part of it. Three or four buds should remain on the scion, and the lowest of these may lie in the centre of the part inserted. The swelling of these buds by slow degrees will prove the junction of the parts brought into contact; but it occasionally happens that actual growth does not take place till the season of the July shoot. It is usual to cut the scions from the parent trees, a month or more before the grafting season, and to keep them in the shade, thrusting their lower ends into moist soil. It is thought that the vital principle is thus preserved, while a sort of thirst is excited, which tends to promote the immediate absorption of the flowing sap of the stock. I doubt the correctness of this theory, as I have found that a freshly cut scion unites with equal rapidity, as one which has been rendered torpid by early amputation; and certainly I have failed more frequently with old scions than with those taken at the moment of grafting. It appears rational that the stronger the principle of vegetative life, the more certain

will be the success of the operation. Each bud on the graft is a system of that life, containing the germs of perhaps millions of vital embryos; and a mutual attractive energy is exerted between the fluids of the stock and those of the graft. As long, therefore, as that period extends, which admits of the operation of grafting, an identity of condition between the two members seems to be a desideratum of no small value. I may be mistaken, but if success attend the practice which I recommend, I feel more disposed to found an hypothesis by induction from facts, than to admit that a thirsty (*i. e.* a dry and semitorpid) condition of the scion, induces it to absorb the rising sap of the stock with avidity.

The foregoing remarks upon crown-grafting will be superfluous to the practised gardener; but to the amateur and the cottager they may—though a digression—be not altogether void of interest.

In preparing an orchard, there are three conditions which require particular attention.

First, The soil. *Second*, The trees which suit that soil, the climate, or locality. *Third*, The treatment of the land. *Fertility*, and remuneration, in one form or other should be the objects of a wise planter; and to secure these the work must be commenced and persevered in with skill and judgment. The following observations will refer exclusively to apple and pear orchards, other plantations being of far inferior consequence.

1. *As to Soil.* It is quite certain that many, perhaps most persons, must be content to make the best of that which they have at command; but if a choice can be exercised, it is certain that good, free, but rather strong, maiden loam situated upon a substratum of chalk, limestone, or marl, to the exclusion of irony gravel, or cold intractable clay, is the earth which the apple tribe delights in. Fortunate is it, where a loam of the quality alluded to prevails to any extent; the usual components of it are a very large proportion of flinty (siliceous) earth, at least 50 or 60 per cent. of the whole, in the state of a fine impalpable powder; of about half that quantity of a coarser flinty sand, with gritty stones; the remaining fourth or fifth part, containing alumen, or the base of pure clay, oxide of iron in a higher or lower state of oxygenation, and chalk. The proportions of the

last three ingredients vary much, namely, from three to six, or eight per cent. of each, in different soils, and regulating their tenacity, colour, and effervescent powers; but the peculiar texture, that which constitutes the distinctive difference between a rich, unctuous, velvety loam, and a binding or gritty earth, appears to depend upon the *siliceous component*. If that exist in a state of extremely fine division, the loam in which it predominates, is firm and solid when dry, but breaks down to the finest earth when gently moistened. If the sand be a coarse gritty gravel, the loam may have the appearance of good earth, but it bends rigidly, and its clods become very intractable.

A free and unctuous loam is, perhaps, not indispensable to the mere farmer and corn grower; but to the gardener in the higher branches of his profession, it is the *sine qua non;* and many a truly skilful cultivator has fretted and repined under repeated failures caused solely by the texture of his loam. The *fruit grower*, also, has abundant reason for congratulation, if he can avail himself of the great desideratum in question, for peach, apricot, plum, apple, and pear-trees, invariably thrive in it. The best preparation an orchardist or fruit cultivator can make, is to provide a large stock of turfy sods, digged spit deep in a common or pasture, whose staple is a rich soft loam; and a first rate orchard of fine and ever prolific dwarf trees, can be advantageously formed in a plot of soil so congenial to the habits and constitution of fruit trees.

2. The choice of trees must, as I before observed, be governed by the quality of soil and climate. Some sorts cannot be made to succeed under the most judicious treatment; therefore it would be folly, under ordinary circumstances, to plant trees which do not generally prosper in the immediate neighbourhood. In that fine loam which I have attempted to describe, I have little doubt that, as far as soil is concerned, every variety of the apple and pear would assuredly grow; but persons must submit to neighbours' fare, and make the most of what they can command. My list comprises the best trees; and I think that few instances of failure would occur, provided sufficient care were bestowed upon the preparation of the pasture for their roots. However, it is impossible to present a list which shall suit every district; and it is very fortunate that some trees affect a ecu-

liar "locale," where they are always prolific. *One good sort*, fertile in habit, and whose fruit is excellent in flavour, is better than fifty varieties indifferently productive. In fact, planters are but too apt to purchase a great many varieties. Hence, they never can command an available stock of any one of them.

It is always desirable to provide maiden trees, one year old from the grafting, because they take to the soil most readily, and are easily trained to the size and figure required. I allude, however, to dwarfs only; for tall standards will in time acquire and retain their natural shape and mode of growth. Dwarf trees are easily managed, always at command, extremely prolific if scientifically educated, and their fruit can be gathered with very little trouble. The common crab-stock is rather too strong for dwarf apple-trees, and so is the wild pear for pear-trees. I have found, as before observed, that seedlings of Siberian crabs make excellent stocks for apples; and little trees of the quince, raised by well-rooted sucker shoots or by layers, are very propitious to pears, even in a very dry soil and district, although the contrary opinion prevails. Any one can raise quince stocks from layers, if he once possess a few little bushy trees, because they produce annually a quantity of shoots from the collar; and thus prolific stools can be formed, by layering the shoots around the parent plants in the autumn or spring. The layers take root very readily; and in October, each may be detached, and planted in nursery lines, where they may be grafted after they have stood one entire year, and till March of the second year. The grafted trees should remain stationary till the following autumn, and then may be transplanted where they are finally to remain.

3. We have now to consider the efficient preparation of the orchard ground, an operation which is absolutely necessary for a perfectly successful result.

Depth of Soil has heretofore been required by most writers, that is to say, a bed of two feet or more of loosened, laborated earth. I claim no such depth. The pulverisation of the soil is indeed a primary requisite, for this implies a well-wrought medium or pasture for the roots; but my object (and herein I do but follow the lead of some very able modern writers) is to force the roots to take an extended, lateral, or horizontal range, and

thus to place them always within the influence of the air, solar heat, and gentle showers. From fourteen to eighteen inches of good loam would be amply sufficient for the roots of any dwarf trees, but the laboration of the earth ought to be complete, and nothing but a thorough trenching with the spade can render it so. I will suppose two distinct cases in order to remove every difficulty, namely, the creation of an orchard in a piece of land which has never been planted with any trees, and the introduction of dwarfs into cultivated ground which has long been under the spade.

First, A piece of ground, say an acre or half an acre, is taken in from a common or pasture-field. It therefore is covered with grass turf. We will pass over the preliminary conditions, that the depth of soil has been ascertained, and the enclosure by paling, or hedge and ditches, duly effected. The turf should be pared off in sods one inch and a-half thick, and laid up in neat square heaps in some convenient situation, the grass surface placed downwards. The decay of the vegetable matter, especially if hastened by a light sprinkling of salt over every third layer of the turfs, would produce a field of the best manure for purposes hereafter to be described. The next step is to open a trench, or line of trenches, according to the number of hands employed, and to wheel away the earth dug out to the opposite side of the plot. All the earth of equable texture and quality ought to be cleared out, so as to ascertain the nature of the subsoil, and whether it be solid and dry, or such as will require draining. If solid chalk or rock be found at the required depth (fourteen to eighteen inches), the circumstance is most fortunate, and nothing need be done. If there be no stagnant or oozing water, but a cold and heavy clay, or ferruginous dry gravel, it will be very proper to throw over the former a stratum of stones, brick-bats, or chalk, four, or even six inches thick, and to ram it down to a hard and solid surface. If gravel predominate, a thick covering of chalk will be the best remedial deposite. In fact, though this carbonate of lime is, when pure, incapable of supporting vegetation, it is not inimical to it when it occurs as a *subsoil*. *Gravel* acts as a sieve, drains off the water which the roots demand, and frequently becomes an active poison to the finer radicles of trees. Chalk absorbs water most readily, and

retains it pertinaciously; and it is a neutraliser of adventitious acidity.

One trench, or line of trenches abreast, being digged and paved as above with stones, bricks, chalk, lime-core, &c., as the case may be, the earth of the next spaces is to be thrown in, and worked and comminuted as much as possible. Each trench is to be treated as was the first, till at length the earth removed from *that* be deposited in the space last excavated, and thus the plot will be completed. Earth so prepared will form a capital bed or pasture for every sort of fruit-tree that is suitable to any orchard. It will require no putrescent manures, or, rather, these ought to be rejected as injurious. This is a fact which must not, however, be taken upon trust, without some philosophical investigation. *Manures are essential* to herbaceous, horticultural, and farm-crops. Why, then, should they prove deleterious to those more woody and permanent tenants of the soil termed fruit-trees? and yet they are so, producing, or at least favouring canker, and diseased growth. If the land be very sandy, manures may be required, but simply because they add a little alumen, chalk, and oxide of iron to a staple which is worthless by itself; but a sound, unctuous loam, is the real pabulum of the fruit-tree, and, therefore, requires no assistance from decomposable substances. An annual, or perennial herbaceous plant, developes a system of roots which actively decompose manures, and, in so doing, form in, and take up from, a very limited space, that immense quantity of nutritive sap which its peculiar organization requires. Its sphere of action is very limited, but therein it exerts amazing energy. A tree, on the contrary, has a less numerous, but far more extended system of woody roots; and these ramify, and wander far and wide in every direction. They seek, and find fresh matter for absorption at every advance, quite contrary this to the concentrative habits of a succulent vegetable. As the latter are voracious feeders, they require decomposable manures, and in return yield, there is little doubt, certain substances by excretion, which imperatively call for a well-regulated rotation of crops. Trees do not appear constitutionally prepared to effect the electro-chemical laboration of putrescent substances; therefore, become affected by contact with them, and either assume a plethoric habit and a tendency to canker and disease, or cease to be fruit-

ful. Manures may safely be applied as a mulch around the stems, and over a certain extent of the surface soil, because the covering, so applied, keeps the ground in a temperate and moist condition, and the rains carry down the soluble parts of the manure in a state and quantity which rarely can do any injury. On the contrary, the slow decomposition which supervenes attracts the tender rootlets toward the surface, and thereby gives them a horizontal direction. On a future occasion I hope to investigate the facts connected with operation of manures, but must now restrict myself to the main subject of this article.

The piece of land being prepared, and the surface of the soil made level, it may, if the trenching have been effected in the spring, be planted with a crop of early potatoes, which will be cleared off by the end of September. This culture will further laborate the soil, and leave it in capital condition for the planting; which ought not to be deferred beyond the second or third week of October; a season peculiarly favourable to the work of transplantation.

The trees which it is intended to introduce being either purchased or grafted by the planter, according to the plan recommended in a foregoing page, will require considerable nicety of management: before I describe this, I think it will not be irrelevant to notice a rule and table by which the number of trees to be planted in any given space of land may be readily ascertained.

First, bring the extent of the area into square yards, by multiplying the breadth into the length; then reduce these yards to square-feet, by multiplying by nine, that being the number of square feet contained in a square yard. Thus, for instance, an acre contains 4840 yards, and that sum multiplied by 9 will yield 43,560; being the product or amount of square feet in a statute acre. In the next place, determine the distance in feet, at which the trees are to stand, and square that number,—that is, multiply it into itself: divide the total product by that square number, and the quotient will indicate the number of trees which the piece of land will contain. Thus,

At one foot apart, an acre will contain .	**43,500 trees.**
At two feet—the square of 2 being 4,—divide 43,500 by 4, and the product will be .	**10,890**

At three feet, the number will agree with that of the square yards, viz.	4,840 trees.
At four feet—the square of 4 being 16,—and 43,500 divided by 16 will be	2,722
At six feet—the square being 36,—the number will be	1,210

Irregular plots of ground will require some modification in the arithmetical calculation, but the table will evince the principles upon which that may be founded.

If the orchardist intend to plant the exact number of trees which will permanently furnish the orchard, the rows should be set out 10 feet asunder, the trees to stand 10 feet apart in the rows, in quincunctal or alternate order, so that every tree of one row be placed exactly opposite the centre of the space between two trees of the rows on each side of it.

The *Operation of Planting* is very simple; but its correct performance depends upon strict attention to two important principles. The first is, that all the roots should be so arranged as to invite them to take nearly an horizontal direction, about 6 or 8 inches below the surface of the soil, and to prevent them from sending down any perpendicular or tap roots. The second principle requires, that the finely pulverised soil embrace and be in very close contact with every portion of the roots. To secure the proper direction of the roots, every tree must be deprived of those which tap, leaving those only that extend internally, nearly at right angles with the ascending stem. The ground must be previously marked out, digging holes, the centres of which should be accurately determined. Each hole should be so deep as to permit the roots to lie 4 or 5 inches below the ground level; and of width sufficient to receive the entire tier without cramping or any degree of pressure. It will in some cases be proper to raise the earth in the centre, to a little convexity, that the tree may rest completely on the soil, which ought to be firmly pressed and made sufficiently compact under it, to prevent any considerable settling. Some persons prune off all the fibres of the main roots, supposing that they must perish and become mouldy. This pruning is entirely needless; but if any great roots be bruised or ulcerated, it will be advisable to cut off the injured part, as these large wounds cannot heal, though the root may not wholly decay, and new fibrous rootlets

will speedily be sent forth within the part retained, and nearer to the collar of the tree. As each tree is placed in the middle of its hole, fine earth is to be sprinkled over every part of the roots; and when enough has been added to support the tree in its upright position, a little shaking or gentle raising of the stem will cause the mould to trickle among the roots. Soft, pond, or rain water should be poured forcibly over the whole space occupied by the roots, more than once during planting, to puddle the soil about, and among them; but I would not, by any means, give water after the final covering with the earth, because this superficial drenching must tend to close the soil, and produce a hard-bound crust impervious to the gentle showers; whereas, if the last addition of earth be left unwetted, and formed into a sort of basin, it will absorb some of the water from the soaked soil below it, and still remain open and pervious to rain. As frosty weather approaches, littery manure may be laid around every tree, to the depth of 4 inches, extending beyond the basin of mould. If the season between the third weeks of October and November prove mild, actual roots may be developed, and the addition of the mulch while the ground remains warm, and prior to frosty nights, will promote the activity of the roots, or, at all events, enable them to form a *callus*, or rudimental process, which will be followed by true roots, as soon as the buds break in the spring.

Maiden Trees thus set, with every necessary precaution, and protected during winter, provided the soil be good, and the succeeding spring prove mild and showery, will frequently shoot, as if they scarcely felt their removal; but old trees, whose roots extend far, and must sustain injury, are but too apt to remain inactive during the first summer.

If a second orchard be contemplated, the trees may be planted at half the before-named distances from each other, in the rows: thus there will be double the number, and one-half of them may be removed to the new plot, in the second or third autumn after the first planting. Trees so treated, move very well; their roots have not become widely extended, but are compact, and may be raised with safety and dispatch. The trees, by the slight check given, speedily assume a fertile habit; and, provided the removal be made in October with due caution, they take to the soil in one season.

I have mentioned the formation of a large heap of vegetable soil prepared from the turfs pared off the pasture or common. This mass, from the instant the grass and its roots begin to decay, undergoes a progressive change. At first, as must be obvious, it consists of a layer of the surface earth, replete with myriads of the fibrous roots of the grass, which forms one side of each sod. But, as decomposition proceeds, the bulk becomes earthy; and, in time, would be found homogeneous in texture and chemical characters. *It is the property of real earths to reduce all vegetable and animal substances to earths of their own precise quality.* On this natural law depend the phenomena resulting from the decomposition of manures. Thus, if the turf pared off the orchard plots were to remain exposed to the action of air, solar light, and rain, it will be reduced to an earth differing in no respect from that which formed the surface-soil of the plot. The reader who is fond of investigating natural causes and effects, would be doing essential service to the cause of science by minutely observing the progress of vegetable reduction; he would thus also gain a clearer insight into the now-mysterious play of affinities between the growing vegetable, the staple earth, and the decomposable medium called manure, which, while it supplies food to the living plant, is itself resolved into a substance that keeps the ground in heat.

To apply this theory to the object for which I recommended the construction of the turf-heap, I now recur to what I slightly alluded to in a previous page, namely, the introduction of dwarf fruit-trees into soil long cultivated by the spade. All kitchen-gardens are herein included, and there are few persons who do not delight to see healthy and fruitful trees in such departments.

I have presumed that manure, when in contact with the roots of trees, is prejudicial to their health; and as the quarters of a well managed garden are often replete, almost to saturation, with decomposable substances, it will not be advisable to plant young trees in a medium so inimical to their earliest efforts. The heap of turf is now at hand, its grassy surface being in a state of progressive restitution into native earth; here, then, we find a material which cannot fail to stimulate the roots of the trees sufficiently, without gorging them with indigestible aliment.

Holes ought to be digged along the borders of the plots, four feet within the gravel walks, and six or eight feet from each other. The depth of the holes may be eighteen inches, and the breadth at least four inches more than that of the space required by the roots to be inserted. Previous to planting, the bottom of every hole should be paved with four inches of well-rammed stones or brick-bats, and then be supplied with turf-earth, or with some other pure maiden loam, in quantity sufficient to receive the tree to a proper depth. The directions for planting, filling up, watering, and mulching described before, will apply in the present instance; and it only remains to be said, that the body of new, simple soil thus introduced will supply the trees during a year or two, after which period a foot more of the garden soil around the first mass should be taken out, the bottom paved, and the circular trench filled up with more maiden earth. Thus, each tree will be preserved from canker for several of the first years of its growth, and its subsequent progress may be undeviatingly healthy. It will not be irrelevant to observe, that all fruit-trees, whether against walls or otherwise situated, will be re-invigorated by the partial application of maiden or turf-loam. A third part of the soil around a tree should be renewed yearly; and, in three seasons, the roots will be supplied with fresh uncontaminated earth. Discretion must guide the operator in respect to depth and extent; but the effects of the process are found to be most gratifying.

The *heading-down* and *pruning* of the trees, with a view to give them figure in the first instance, are now to be considered. To the former of these operations I do not agree with those who think that a young tree ought to be cut down very low in order to give it strength. But it is requisite that a certain number of primary branches be found at a short distance from the ground; and, therefore, something must be done to procure them. Maiden trees have usually one upright shoot, formed by the graft, but there may be two, three, or four shoots. The point of grafting ought not to be more than six inches above the soil, and the shoot or shoots should ascend or branch out from that point. Suppose, then, that only one erect shoot, nearly one yard long, be produced, then it will be necessary to cut back that shoot to the length of six inches above its origin, by which means three

or four of the eyes remaining will be excited to send forth as many new shoots. If the tree have two branches, it is not so eligible as one with three or four branches, but is more fitted to become an espalier tree than an open dwarf. Trees with three or four shoots, well and regularly produced, are valuable; they may be so shortened by sloping cuts made a half or the third of an inch above, and in the direction of, a bud, so as to leave the shoot from six to twelve inches long, according to its strength, the weaker to be more curtailed than the stronger; because, by inducing the latter to break a great number of its buds, its strength may be more divided, and thus equality, or a true balance, be given to the members of the trees.

Gardeners are at variance respecting the period and season of heading down the maiden-trees; some insist that they ought not to be cut till they have passed over one entire year after the planting. I have tried every method, and fear not to say that, if a strong young tree be perfectly well planted just before the leaves fall, or have quite changed colour, it ought not to be touched during the first autumn or winter, but that in the following year, just at that period when the buds begin to swell, it may be cut back with safety, and perhaps more beneficially than at the corresponding season of the second year. My reason is this. If the pruning be performed at the time of planting (October), the wounds remain exposed unhealed to the fickleness and severity of the winter; but if the tree, at the commencement of the following April, be sufficiently vigorous to *enlarge* its buds, it will be equally so to effect the development of three or four of its lowest eyes, and thus to produce as many young branches close at home, and that, too, at a season when the vital fluids of the glandular coat of the bark will produce healthy granulations over the wounded surfaces. Were the shoot or shoots left wholly unpruned, the leading buds alone would, in all probability, advance, leaving a great length of the wood, of two different years' growth, to be cut back to the proper distance above the graft.

One more remark on the first preparatory operation remains. Every tree should have a single main stem, from six to nine inches long above the surface of the soil, and this stem ought to be that of the *stock*; the scion may branch off just above its insertion, but the few inches of clear stem tends much to add

figure to the tree, and to facilitate the future operations of clearing, weeding, hoeing, or light digging and mulching the surface-soil.

The objects of pruning are to produce a tree with a regular open head, the branches of which radiate, as nearly as the habits of the tree permit, from a central stem, obliquely ascending at a certain angle till they nearly meet the branches of the neighbouring trees. The height of the trees should not exceed six or seven feet, and each branch ought to be covered with fruitful spurs throughout its entire extent; thus great productiveness will be effectually provided in a comparatively short period.

In respect to the form of the dwarfs, the rules given by Lindley may be cited as practically correct. Writing on the proper *regularity of a well-balanced head*, he observes, that if this be "effected at first, there will be no difficulty in keeping it so afterwards, by observing either to prune to that bud immediately on the inside next to the centre of the tree, or that immediately on the outside. By this means, viewing it from the centre, the branches will be produced in a perpendicular line from the eye; whereas, if pruned to a bud on the right or left side of the branch, the young shoot will be produced in the same direction: so that if the branches formed round a circle be not thus pruned to the eyes on the right successively, or the left successively, a very material difference will be found, and the regularity of the tree will be destroyed in one single year's pruning." (*Guide*, p. 120.) These remarks apply to the leading buds only, but by those annual spring or late winter-prunings, which every principal branch will require, till it attain the intended height (and by which the wood produced in the preceding summer should be curtailed to about one-third of its length), a number of lateral, secondary shoots are excited to grow, which, if left unregulated, would speedily fill the tree with useless ill-placed wood-shoots. It is in the scientific management of these laterals that the production of a majority of the fruit-bearing spurs depends.

To explain the processes of spurring, according to my views of the physiological structure and vital action of these trees, I observe, first, that, supposing, at each winter-pruning, the leading shoots be cut down two-thirds or half its length, to a bud properly situated to form the leading shoot of the ensuing summ-

mer, other shoots, perhaps three or four, will push from the lateral buds below the lead. These shoots seldom extend more than a foot; but they are likewise furnished with buds similar to those of the parent shoot. Besides these, there are small embryo buds, just above the exsertion of the shoots, which would remain dormant were the true buds permitted to expand.

The gardener endeavours to excite these embryos, and thus to obtain a number of fruitful germs in lieu of those leaf-buds which garnish the shoot. He therefore cuts back those laterals to within one or two inches of the shoot upon which they grow, at some period of June or July, when their wood has become somewhat mature and firm. It will be recollected that there are two seasons of vigorous growth: the one in May, earlier or later, and this is termed the spring-shooting; the other about July. Now, if the laterals be cut back at or before the season of the July shoot, the embryo or lower buds will be stimulated, and produce, in most instances, a multitude of weak wood-shoots, all of which must be cut out, or if one be left, as some recommend, it has to undergo the same sort of treatment, and with a similar result; thus time is wasted, the powers of the tree are taxed to no purpose, and no fruitful buds are obtained. The critical period appears to me to be that which is not remote from, but posterior to, the July shoot, then the wood will be firm, and almost ripe at the lower extremity of the shoots, and the fluids of the tree, though not inactive, in a state of comparative quietude. But even in this situation, the shoots should not be cut entirely off, but broken, or snapped by the hand, at the third of its length below the point of each, leaving the fractured extremities suspended by the bark, and not wholly detached. By this cautious (though, I must confess, not elegant) mode of foreshortening, the fluids of every shoot are kept in perpendicular, but greatly diminished action, and are constrained to enter into the *lateral buds* throughout the whole of the unwounded part of the shoots, and also into the embryos at their base. These buds and embryos enlarge, but do not push into shoots, and of many of them, situated low on the shoots, one or more will, at the period of the following early-spring pruning, be found swollen into fruitful buds. Then, and not till then, every shoot should be cut back, either to within an inch of the fruit- bd

(now a spur), or, if none such be yet formed, to a point just above a bud situated at an inch or two above the origin of the shoot. The foreshortening above described is to be repeated, year after year, till every lateral produce a fruit-bearing spur. But, independent of these artificial spurs, numbers of others are naturally protruded along the branches of apple and pear trees, and these are always preferable to the others produced by the interference of man; nevertheless, as in these dwarfs, it is indispensably required that every main shoot support a series of fruit-spurs, art must be excited to check the luxuriance of the trees, and constrain them to become prolific.

The foregoing remarks apply chiefly to the trees of the orchard, especially in what respects the dimensions of the trees; but the dwarf trees of the garden are not intended to attain to half the size of the others, they therefore must be pruned very rigorously for spurs. They are intended to bear great quantities of the finest fruit in small compass, and can be made to do so; exhibiting garlands of flowers in the spring of surpassing beauty. Once formed, a dwarf tree, scarcely four feet high, having six regular branches, may be kept within the same limits during many years, and be at all times renewable by shoots, which, rising near the fork of the old ones, may be gradually substituted for those that have become unsightly.

In the routine regulation at the period of winter-pruning, as Lindley justly remarks, "care must be taken to keep the spurs short and close, none of which should exceed three inches; cutting clean all the blank spurs which have produced fruit the previous summer, to the perfect bud below." By the term winter-pruning, I always presume a period just preceding the enlargement of the buds in March or April, because the fluids, excited by the springy influences, are ready, at their first flow, to heal the wounds, and produce the deposition of new vegetable matter.

I believe that it is the torpid condition of a wound which causes disease, under the action of cold frosty winds, snow, and protracted wet, during the winter. Some object that a tree will "bleed," if the knife be used in the spring, but facts do not bear out the assertion; and I never yet perceived any injurious results from the bleeding of the *vine*, although the watery sap has

oozed from the point of the leading stem for days, and fallen in rapid drops, which might be collected in quantity sufficient to be chemically analyzed.

Tall *open standards*, for large orchards, do not become the subjects of present inquiry; but it may be stated, in few words, that the ground should be prepared equally well for them as for dwarfs, that, being trained and pruned, during three or four seasons, with judgment, they should then be left to form the figure which the nature of the variety inclines it to assume.

Great trees bear large quantities of fruit; but they require much time to come into full bearing; they then occupy much space, and the gathering of the fruit is at all times troublesome, and is attended with very considerable risk of injury to the fruitful spurs. Nine dwarfs may be brought into a state of vigorous fertility on the same extent of ground occupied by one large standard tree, and in less than one-third of the time. The other comparative advantages are obvious, and I think confer the palm on the dwarf system of culture.

ON THE DISEASES INCIDENT TO THE MOST USUALLY CULTIVATED PLANTS. NO. I.

By George W. Johnson, Esq., Corresponding Member of the Maryland Horticultural Society, &c.

The smut, which occasionally ravages our corn crops; the mildew that destroys our peas; the curl which is yearly spreading more widely over the potato districts; the anbury, or club-root, to which our turnips and other species of brassica are liable, are only a few of the most commonly observed diseases to which the plants we cultivate are liable. Mr Good, the distinguished medical writer, many years since remarked, that the morbid affections to which the vegetable part of the creation is liable, are almost as numerous as those which render decrepid and destroy the animal tribes. It would perhaps be difficult, whatever system of nosology is followed, to lay the finger upon a class of animal physical diseases, of which a parallel example could not be pointed out among plants.

Numerous as are the vegetable diseases, and destructive as

they are to the interests of the cultivator, yet no subject connected with his art has obtained so little attention, and never was even trivial attention followed by benefit less important. The reason of the deficiency of benefit is not difficult to explain. Common experience teaches us that diligence and perseverance, directed by judgment, are the essential preliminaries to success. In examining—in searching for the causes of the diseases and decay of vegetables, we have fewer guides, less assistance from the individuals affected, than we have from a diseased animal; fewer symptoms marking the commencement, or seat of the evil: yet where is the cultivator who ever took a fraction of the care exercised or decimal of the attention to discover the cause, the progress, or the cure of one disease that sometimes brings ruin by the destruction of his hoped for harvests, as he does to detect the disorder of, and the panacea for, some miserable pig? Diligence, perseverance, and judgment, then, have never for any length of time been directed to the diseases of plants; they are yet without their Æsculapius.

The subject is one of difficulty, but it is commensurately important; difficulty is very far distinct from impossibility; and the importance of the research is a stimulus to exertion. I shall in this and some following papers endeavour to throw some light upon the path upon which I strenuously seek to persuade practical men to proceed. I would ask of such men to *think* upon the subject; to *observe;* "to ask questions of Nature," as the philosophic Bacon expressed his just idea of experiments. Human knowledge is acquired by observation and experience; that is, by conversing with the things about us, by noticing them attentively, and subsequent reflection. Every cultivator is capable of doing this; and if when he found his crops diseased, he would reflect and record from what soil he obtained his seed; how and in what weather it was committed to the ground; its subsequent culture; the crops that preceded; the treatment of the soil; the seasons, whether wet or dry, or severe, through which it has vegetated; with any miscellaneous observations that his own common sense might dictate, vegetable medicine would soon advance more in one year towards that state of reasoned knowledge that deserves the name of science, than it has done during the last century. As observations multiply, the adjutant sciences, Chemistry and Botany,

will contribute and apply their improved stores of information; and if few specifics for the diseases of plants are discovered, I am quite sure the causes of disease will be better ascertained, and every one is aware that to know the cause of an evil is the most important step towards its prevention.

It is a very important preliminary to the study for which I would gain the attention of practical men, that they understand the nature of plants; of those organic creatures whose diseases they would obviate; for an ignorance of, or an inattention to this, is one of the causes that so little progress has been made in this branch of natural philosophy. It is absolutely necessary and important for them to understand fully that this part of the creation, the very grass they trample upon, is so highly organized, so exhibiting intimations of the functions more highly developed in the superior animals, that it is not possible to point out where animal life terminates, and where vgetable life begins: the zoophyte connects the two kingdoms. It is absolutely necessary, I think, for this to be understood and felt by those who enter upon the investigation of vegetable diseases, because I have a strong opinion that these in many, very many instances, are caused by the plants which they infect being treated as if they were totally insensible, inorganic matters, scarcely more susceptible of injury at some periods of their growth than the soil from whence they partly derive their sustenance.

To determine the question whether plants possess a degree of sensation is not so easy as many persons may believe. "It is as difficult," says Mr Tupper, who has written ably upon the subject, "to ascertain the nature of vegetable existence, as to determine what constitutes the living principle in animals." Darwin, by the aid of imaginary beings similar to the Dryads and Harmadryads of the classic mythology, has raised plants to a position in the order of nature superior to that to which animals are entitled. Other philosophers taking a totally antagonist opinion estimate vegetables as bodies, only somewhat more organized than crystals, but like these entirely and exclusively subject to chemical and mechanical changes.

The above opinions are equally erroneous, as will appear from the facts arranged in the following pages. It might easily be made to appear that the gradation from reason to instinct, from

ct to inanimation, is as gradual as the transitions of light the noon-tide to the midnight of a summer's day; but this must be confined to that section of creation that commences the close of the animal classes in the zoophyte, and termi- where inorganic matter commences in the crystal; and its ls must be specially directed to demonstrate how closely it aches, how indistinctly it is divided from the former.

t us first consider the comparative composition of animals lants demonstrated by the researches of chemists. Their ituents are identical: carbon, hydrogen, oxygen, nitrogen, ur, phosphorus; acids, alkalies, earths, and metals are ommon components of both. Nitrogen has been consider- r some chemists as the constituent, marking by its presence al from vegetable matters, but the distinction fails in as as that from some animal matters it is absent; whilst in luten of plants, a chief constituent of wheat, and in the frame of the tobacco, it is present.

we follow the above chemical bodies through their combi- ns, we shall find that these in animals and plants are closely ar; and in both are equally numerous and intricate.

the acids there are contained in

Animals.	*Vegetables.*
1. Sulphuric,	1. Sulphuric,
2. Phosphoric,	2. Phosphoric,
3. Muriatic,	3. Muriatic,
4. Carbonic,	4. Carbonic,
5. Benzoic,	5. Benzoic,
6. Oxalic,	6. Oxalic,
7. Acetic,	7. Acetic,
8. Malic,	8. Malic,

others equally numerous in each, but not common to both. he earths and alkalies, lime, magnesia, silica, soda, and po- are found in each class. Of the metals, iron and manga- are their conjoint constituents.

we follow the two classes through their more compound ituents, we will find the analogy still holds: they contain mmon sugar, mucus, jelly, colouring, and other principles, n,* fibrin, oils, resins, and extractives. The functions of als and plants are similarly closely analogous.

nimals take in their food by the agency of the mouth, and

* The gluten of plants is the albumen of animals.

prepare it for digestion by various degrees of mastication, or attrition, as in the gizzard of birds. In this they differ from plants, but these have this compensation, they imbibe their food in a liquid form, and consequently in a state of the finest possible division. Animal and vegetable remains are their common food, plants having this superiority over animals, that, as they only absorb the soluble and finer parts, they are not obliged to throw off the grosser constituents which appear in the excrement of animals.* In the animal stomach the food undergoes an extensive change, being reduced to a pulp of greater specific gravity, and being altered entirely both in taste and smell. In the lymphatics of plants, which may be considered their primary organ of digestion, their food, or lymph, undergoes a change precisely similar; its colour and flavour are altered, and its specific gravity increased.

From the stomach the animal's food passes into the intestines, is there subjected to the action of the bile, and converted into chyle the nutritive part, and excrementitious matter. In their passage through the intestines, the chyle is absorbed by the lacteal vessels, and is conveyed into the blood; by the heart, the mingled fluids are propelled into the lungs, to be there exposed to the action of the air. The vital fluid there changes its purple hue for a florid red, loses a portion of its watery particles and carbon; the latter combining with the oxygen of the atmospheric air in the lungs, and being breathed forth in the form of carbonic acid gas. As plants in their food take in no gross, unnecessary ingredients, it is obvious that no process like the biliary operation of digestion is required. The lymph, or sap, proceeding at once along the branches, is poured into the leaves, the very lungs of plants. There, as in the blood, its colour is changed, oxygen is emitted from it during the light hours of the day; but carbonic acid gas is thrown off during the night, and at all periods a considerable quantity of water.

From the lungs, by the agency of the heart, the blood is propelled through the arteries over the whole animal system, supplying nourishment and warmth to all the parts, and where, by these abstractions, it is again converted into purple or venous

* Is not the excretion from the roots of plants, as proved to exist by M. De Candolle, somewhat analogous to the excrementitious matter of animals? Editor.

blood, it is returned by the veins to undergo the changes that were described as being effected by the lungs.

The sap, after exposure to the action of the air in the leaves, is returned by another set of vessels situated in the bark, ministering to the growth and support of the whole plant.

Such is the close assimilarity in the digestive and circulatory processes of the two classes; an assimilarity which obtains in all the other functions enjoyed by them in common. In respiration, the air inhaled through the mouth and nostrils proceeds immediately to the lungs and acts upon the blood; in plants, when it is inhaled by their leaves, it operates instantaneously upon the sap. The changes that take place have just been imperfectly noticed; but it is necessary to add, that the oxygen of the atmosphere, is the gas essential to the existence of animals; but it is its carbonic acid that is nearly as important to vegetables. They may be considered the vital airs of the two classes. If animals are placed in a situation where they inhale pure oxygen, their functions are highly and rapidly increased; but it is an exhilaration which would soon terminate in exhaustion and death, if breathed by them for any extended period. So plants will flourish in an atmosphere containing $\frac{1}{12}$th of carbonic acid, but if it much exceeds this proportion, they are rapidly destroyed. During sleep, animals expire less carbonic acid than during their waking hours; so plants emit little or no oxygen during the night.

After an animal has enjoyed the regular course of its functions for a period varying in its duration, the time at length arrives when decay commences. The wasted, enfeebled, and relaxed form gradually declines, until death finally closes all activity. The body then becomes contracted and rigid; the skin exchanges the ruddy tinge of health for death's pallid hue. Decomposition speedily ensues, with all its offensive phenomena; and finally the only permanent remains are the skeleton and a small amount of earthy matter. The same characteristics attend the last period of vegetable existence. Plants may flourish only for one season, or their lives may be extended through centuries of years, yet decay eventually comes over them; becoming more and more stunted, weak, pallid, and ragged, they eventually cease to live, become contracted and rigid, and pass through the

same phases of putrefaction that are exhibited by the animal carcass. In both there was a time when warmth and exposure to the atmosphere were the sources of vigour, they now become the agents of destruction; they were once able to resist and to overcome the laws of chemical affinity, they now are destroyed by their attacks. What causes this most striking change? What antiseptic agent have they lost? There can be but one reply. It was their vitality. Now, let us examine how the vitality of plants in other respects resembles the vitality of animals, and I will confine this examination to two or three points.

Plants are *excitable*. Light acts upon them as a stimulus. Every body must have observed that plants bend towards the direction from whence its brightest influence proceeds. M. Bonnet, the French botanist, demonstrated this in some very satisfactory experiments, by which he shewed that plants grown in a dark cellar all extended themselves towards a small orifice admitting a few rays of light. Every flower almost has a particular degree of light requisite for its full expansion. The blossoms of the pea, and of other papilionaceous plants, spread out their wings in fine weather, to admit the solar rays, and again close them at the approach of night. Plants requiring a powerful stimulus do not expand their flowers until noon, whilst some would be destroyed if compelled to open in the meridian sun,—the night-blooming *Cereus* unfolds its flowers only at night. Heat also acts as a stimulus upon plants. M. Duhamel observed, that during moderately fine weather the footstalk of a leaf of the sensitive plant (*Mimosa pudica*) stood in the morning at an angle with the lower part of the stem of 100°; at noon the angle had increased to 112°, but at night had fallen to 90°. If a leaflet of this plant be but slightly touched, it immediately shrinks away; and the impulse being communicated, each pair of leaflets on the branch collapse in succession; and if the impulse be strong, the very branch itself will sink down by the side of the stem. If an insect alight upon the upper surface of the Venus's fly-trap (*Dionœa muscipula*), its sides spasmodically approach each other, and crush to death the intruder. If the inner side, near the base, of any one of the anthers of the barberry (*Berberis vulgaris*) be gently touched, as with a bristle or feather, it instantly springs forward and strikes against the stigma. But

the strongest indication, says Mr Keith, of the existence of a species of sensitive principle in a plant, is, perhaps, that which is exhibited by the *Hedysarum gyrans*. It is a native of India, growing on the banks of the Ganges. Its leaves are ternate, the middle leaflet being larger than the lateral ones. All of them are in constant vibratory motion; sometimes equably, at other times abruptly, but without any unison in the movements. If their motion be prevented, by grasping them in the hand, they renew it more vigorously when the confinement is removed, but by degrees subside to their natural rapidity of motion. This motion does not depend upon the application of any external stimulus, for it continues throughout the night as well as the day. It is most active during a warm fine day, the leaves then having an additional tremulous motion. (*Keith's System of Physiological Botany*, ii. 464.)

Instinct seems to be a characteristic of plants, from the following phenomena. Some of them close their flowers invariably when rain is approaching. Others have an unalterable direction assumed by them when climbing. No force can make one twist round a pole from left to right, if its natural direction be from right to left. If a garden pot be divided by a vertical partition, and one half filled with a poor steril earth, and the other moiety filled with a rich fertile soil, a geranium or other plant placed in this pot, with some of its roots over the steril soil, and the rest of the roots over the fertile soil, those over the first named portion will gradually change their direction until they can also get into the richer pasturage. Instances have been known of the roots of trees piercing and destroying walls in their efforts to attain a more preferable soil than that in which they were planted. M. Saussure relates, that he placed some plants of *Polygonum persicaria* and *Bidens cannabina*, in water containing acetate of lime in solution. These plants then imbibed with the water a portion of this salt; but when they had the opportunity of selection given them, by dissolving in the water some common salt, glauber salt, and acetate of lime, they absorbed the two first named, but rejected the latter entirely. (*Saussure's Recherches*, 247–261.)

From the foregoing facts, without arguing that they demonstrate sensation to exist in plants as acute as that possessed by

the higher or more perfect classes of animals, yet they certainly are satisfactory evidence that plants probably are nearly as sensient as the Zoophyte, or even as the Polypus and the Hirudo,—animals that may be cut into pieces, and each section become a perfect individual,—animals whose heads may be taken off and grafted upon other bodies,—animals that may be turned with their outsides inwards, and yet without any apparent inconvenience. If plants be endowed with sensation of the most limited degree, it explains the cause, throws light upon the prevention of many diseases that affect those which are the object of cultivation, warns the tiller of the soils from the late performance of many of his operations, and teaches him generally to be less violent in his field practice. If a grape vine be pruned too late in the spring, the bleeding, or effusion of sap, has been known to be so violent, that the tree has died from absolute exhaustion. Stone fruits, if severely wounded, are frequently destroyed by the inroads of a disease resembling in all its characteristics the cancerous affections of animals ; and I have known a whole crop of wheat affected with a swelling of the stem or culm, evidently caused by an extravasation of the sap from its ruptured internal vessels, owing to the roller being passed over the crop when of a growth somewhat too forward.

After these prefatory remarks, intended to save from fundamental objection the opinion I entertain, that most, if not all the diseases of plants, are connected with or arising from causes affecting their vital power,—for these remarks exhibit facts and reasons establishing the existence of such power in plants,—I will now proceed to consider in detail, and illustrate by experiments, some of the most prevalent diseases of our cultivated plants.

The Curl.—No disease appears to me so evidently to arise from impaired vital energy in the plant, as the curl that of late years has made such extensive ravages upon our potato crops.* Any one can insure the occurrence of this disease, at least I have found so in the county of Essex, by keeping the sets in a situation favourable to their vegetation, as in a warm damp outhouse, and then rubbing off repeatedly the long shoots they have

* The opinion of Mr Munro of Brechin nursery, coincides with mine. He considers "weakness is the cause" of the disease. See *Gardener's Magazine*, vi. 417.

thrown out. Sets that have been so treated, I have invariably found produce curled plants. Is not the reason very apparent? The vital energy had been weakened by the repeated efforts to vegetate; so that, when planted in the soil, their energy was unequal to the perfect development of the parts; for the curl is nothing more or less than a distorted or incomplete formation of the foliage, preceded by an imperfect production of the fibrous roots.

The following experiment I consider as very decisive: it was made in the year 1830, in my garden at Great Totham, in the county of Essex. The soil in this case, and in all others that will be stated hereafter, unless otherwise specified, is light, deep, moderately fertile, resting on a substratum of siliceous gravel, and is constituted as follows.

Water,	30.5
Stones and coarse sand,	15.5
Vegetable fibres,	5.
Saline matters,	4.5
Oxide of iron,	2.5
Carbonate of lime,	17.5
Decomposing matter,	7.
Alumina,	15.
Silica,	102.5
	200.

The variety employed in this experiment was the Early Shaw. An equal number of whole moderately-sized potatoes, that had been treated in three different modes, were planted the last week of March. No. 1. Twenty sets that had been carefully kept cold and dry throughout the winter, firm, unshrivelled, and with scarcely any symptoms of vegetation. No. 2. Twenty sets that had been kept warm and moist, and from which the shoots, after attaining a length of six inches, had been thrice removed. No. 3. Twenty sets which had been kept warm and moist for about half the time that No. 2 had, from which the shoots, three inches in length, had been removed only twice.

All the sets were planted the same morning, each exactly six inches below the surface, and each with an unsprouted eye upwards. The spring was genial.

Of No. 1, nineteen plants came up. The twentieth seemed

to have been removed by an accident. Of the nineteen, not one was curled. The produce a full average crop.

Of No. 2, all came up, but twelve days later than those of No. 1; and three of the plants sixteen days later. Fourteen of the plants were curled.

Of No. 3, all came up, but from ten to fourteen days later than No. 1. Four plants were as severely curled as those in No. 2, eight were less so, and the remainder not at all; but of these the produce was below an average, and a full fortnight later in ripening.

Dickson, Crichton, Knight, and others (*Caledonian Hort. Mem.*, *Horticultural Trans.*, *Loudon's Gardeners' Mag.*, *&c.*), have found, that tubers, taken up before they are fully ripened, produce plants not so liable to the curl as those that have remained in the ground until completely perfected; and I believe, under ordinary treatment, this to be the fact, for it is rational. The process of ripening proceeds in the potato, as in the apple, after it has been gathered, and until that is perfected, it is accumulating vigour, shews no appetency to vegetate, consequently is not exhausting its vitality,—which is a great point, considering the careless mode usually adopted to store them through the winter,—for this energy commences its decline from the moment it begins to develop the parts of the future plant. Tubers taken from the soil before perfectly ripe, never are so early in shewing symptoms of vegetation. Crichton, Hunter, and Young, in some of the works before referred to, have also agreed, that exposing the sets to light and air, allowing them to become dry and shrivelled, also induces the curl in the plants arising from them. This result of experience also confirms my conclusion, that the disease arises from deficient vital energy; for no process, more than this drying one of exposure to the light and air, tends to take away from a tuber altogether the power of vegetating. A farmer, Mr G. Allaker, residing in the same village that I do, employed last year (1836) rather small sets: cutting a moderate-sized potato into at least two pieces. Unfavourable weather, other business, and a somewhat dilatory habit, caused him to leave those sets upon a barn floor, drying for more than a week. He planted with them a two-acre field, and not more than three-fifths vegetated, of which three-fifths, a fourth were in various degrees curled.

Similar results were obtained in the experiments of Mr Wright, a market gardener of Westfield. When the sets were allowed to ferment in a heap, allowed to sprout, &c., he had a crop, one-fifth of which was curled.—*Gardeners' Mag.* x. 436.

Every one acquainted with the cultivation of the potato, is aware of the great difference existing in the varieties as to their early and rapid vegetation; those that excel in this quality, of course, are the most easily excitable. A consequence of this is, that they are always planted earliest in the spring, before their vital power has become very active; and of all crops, practice demonstrates these early ones are least liable to the curl. But what is the consequence, on the contrary, if an early variety is planted for a main crop later in the spring, when extraordinary pains in keeping them cold and dry have not been employed to check their vegetation, and consequent decrease of vital energy? Such crops, then, more than any other, is liable to the disease.

The statements of a practical man in the *Gardeners' Magazine*, vol. x. 433, entirely support my views of the disease. He remarks, that, in 1826, through the prevalence of rain, the late crops of potatoes never sufficiently ripened so as to be marketable. They were reserved for planting next season, and the consequence was, that the curl affected the crops that year to a great extent; but those who planted well-ripened tubers had crops free from the disease, and as productive as usual. Now we all know that the vital energy is always the most powerful in a bulb or seed that is perfectly ripened.

The results of my view of the disease, sustained by numerous experiments, are, that it will never occur if the following points are attended to:—1st, That the sets are from tubers that exhibit scarcely any symptoms of incipient vegetation. To effect which, they ought, throughout the winter, to be preserved as cool, as dry, and as much excluded from the air as possible. 2dly, That the tubers should be perfectly ripened. 3dly, That they should be planted immediately after they are cut. 4thly, That the manure applied should be spread regularly, and mixed with the soil, and not along a trench in immediate contact with the sets. 5thly, That the crop is not raised for several successive years on the same area.

ON THE UNEQUAL DISTRIBUTION OF, AND UNEQUAL ASSESSMENT FOR PUBLIC BURDENS IN SCOTLAND.

MUCH importance is in this country attached to *political* reforms,—to the improvement of our national institutions, and the extension or equal participation of civil privileges. But there is another kind of reform, which to all classes of the community is no less material, viz. *financial* reform, by which the burdens imposed on them for the support of the State, may be reduced and lightened.

There are two ways in which this last kind of reform may be effected. The one is by diminishing the *amount* of the public expenditure; the other is, by *equalizing* the burdens over all classes of society, according to their means of bearing them.

The first of these financial reforms has been already tried, and carried to a great extent. The amount of taxation, in consequence, has, within the last six or seven years, been reduced by many millions;—whereby additional elasticity and energy has been given to capital and industry in almost every quarter. There is, however, a limit to retrenchment in the public expenditure,—which some think has been already reached if not overstepped, and which at all events, it will be allowed, cannot be far distant. But there remains still the other plan of relief, by which, though the weight of taxation is not lessened, it is equally distributed over the body politic in such a way, that no one class bears more than its due proportion. The advantage of such an adjustment of taxation is perfectly obvious. The prosperity of a country depends chiefly on its capital and industry being allowed to flow freely into every channel; and this object cannot be attained, unless the pressure of taxation be laid on each class according to its capability to bear it. Adam Smith states it as the first and most essential maxim of taxation, that "the subjects of every state ought to contribute towards the support of the government *as nearly as possible in proportion to their respective abilities*; that is in proportion to *the revenue which they respectively enjoy* under the protection of the state. The expense of government to the individuals of a great nation is like the expense of management to the joint tenants of a great estate."

This maxim, dictated alike by common sense and the soundest philosophy, has been grievously lost sight of, and overlooked, in the allocation and distribution of public burdens in Scotland. That this should have been the case, is perhaps less surprising, when it is considered that the extent and complexity of the taxation formerly must have had no small effect in lessening the relative importance of these inequalities,—perhaps even in concealing their existence,—and, at all events, in reconciling most people to bear their proportions of a burden from which none was then exempt. But now that the national taxation has shrunk into smaller dimensions, and that the effect of recent reductions has been to remove the burden entirely from some classes, and only partially from others, these inequalities have become greatly more apparent. They have, from the same cause, been made to operate much more injuriously than before in depressing particular interests; so that, however extensive and beneficial the reduction of the amount of taxation has been, it is just on that account the more necessary, to correct the inequalities which that reduction has rendered prominent, and made to be more keenly felt.

To shew that these remarks are not the suggestions of mere speculation, and that they are strictly pertinent to the present system of taxation in Scotland,—let us only consider what are the different taxes levied in Scotland, and what are the classes from whom they are drawn. The existing taxes may be classed under the following heads:—

1. Excise, Customs, and Assessed taxes.
2. *Cess or land-tax*, paid by Royal Burghs, and Counties.
3. Assessments in Counties for the expense of *detecting, convicting, alimenting, and punishing criminals.*
4. Do. in Counties and Royal Burghs, for building and maintaining *prisons, court-houses, &c.*
5. Do. in Counties, for building and maintaining *bridges.*
6. Do. in Counties, under act for *weights and measures.*
7. Do. in Counties, for damages done by *riots, &c.*
8. Do. in Counties for salaries to *jailor, clerks of the peace and of supply, constables, &c.*
9. Do. in Parishes, for building and repairing *churches, church-yard walls, &c.*

10. Do. in Parishes, for building and repairing *manses, providing glebes, &c.*
11. Do. in Parishes, for building and repairing *schools, and schoolmaster's house, providing garden, &c.*
12. Do. in Parishes, for *schoolmaster's salary.*
13. Do. in Parishes, for alimenting *paupers.*

Now, of the above taxes, all except those embraced under the first head, are *direct* taxes,—a mode of taxation which every writer on political economy admits to be most inexpedient and disadvantageous. But this is an evil of very minor importance, compared with the one which it is our present object to point out. In order to judge whether the burden of these taxes, both direct and indirect, is fairly and equally distributed, let us consider from what classes they are severally drawn. First, the *direct* taxes.

The *Cess* or *Land-tax* drawn from Scotland was fixed by the 38th Geo. III. chap. 5, at L.47,954, and was allocated among counties and royal burghs in certain proportions,—the counties contributing five-sixths, and the burghs one-sixth of the above sum. That act appointed it "to be raised *out of the Land-rent* of Scotland." And for the purpose of levying it, commissioners in each county and burgh were named, who were authorised "to do every thing concerning the said supply, as is prescribed and appointed by the Cess Act of the 9th November 1706, and other acts made in any former Parliament in Scotland." The assessments made in the counties, is *upon* such only as have *heritable* property.

The next tax,—generally termed the *Rogue-money*, is levied exclusively in counties, and is drawn from such persons only as have *heritable* property.

Though by old acts, it was obligatory on royal burghs, as well as counties, to have proper *gaols* for the reception of debtors and criminals,—it is notorious, that the obligation thereby imposed on royal burghs has fallen into almost total desuetude. We do not rate the proportion of the expense under this head borne by the Scotch counties, too high in stating it at nine-tenths of the whole. The individuals who pay it are also such only as have *heritable* property.

The expense of maintaining *bridges* falls exclusively on *heritors* in the several counties.

The same remark applies to all the other taxes in the above list, with the exception of the one for alimenting paupers. The poor of royal burghs are supported out of the burgh funds, or by a tax on the inhabitants. In all other cases, the expense falls, by law, equally on the heritors of the parish, and on the rest of the inhabitants;—the one-half being paid by the one class, according to the rents of their properties; the other half being paid by the second, according to the income of their personalty. We may add, that though this is the *legal* mode of assessment, the practice in most parishes is, *to lay the whole expense on the heritors.*

We thus see, that all but three of these *direct* taxes fall exclusively on the landed proprietors; and that of these three, five-sixths at least are drawn also from that class.

It is not quite so easy to ascertain the proportion of the *indirect* taxes paid by landed proprietors. It may, however, be fairly assumed, that they contribute one-half of the whole *assessed taxes*; and as to *customs* and *excise*, when it is considered that those levied on malt, whisky, and hops, alone exceed one-third of the whole revenue arising under this department, it will be admitted that the agricultural classes sustain at least a full and equal share of the burden.

From the almost total want of any statistical information on the subject of Scotch taxation, it is difficult to discover the exact amount of the burdens borne by the landed proprietors. With the view of supplying this deficiency, we have been at some trouble in obtaining returns for the last seven years, from as many counties as possible, of the various assessments levied in them; and, with the materials collected in this way, we have been enabled to present the following estimate:—

The total amount of *Land-tax* exigible from Scotland is, as already stated, £47,954, of which laid on counties, . . .	£39,962
The *Rogue-money*, on an average of several counties, say .	32,000
The expense of erecting and maintaining *prisons*, *court-houses*, &c. in Scotland, may on an average be stated at £25,000 yearly, of which incurred in *counties* at least . . .	20,000
Bridge-money on an average of several counties, say . .	5,250
Carry over,	£97,212

Brought over,	£97,212
Assessment under *weights and measures* act,	3,000
Expense of erecting and repairing *churches*, &c. in 900 out of 1023 parishes,	30,000
Do. for *manses*, &c. in do.	15,000
Do. for *schools*, &c. in do.	9,000
Do. for schoolmaster's *house*, &c.	9,000
Schoolmaster's *salaries* in do. *	31,000
Aliment of paupers, in all £150,000, of which raised in *landward* parishes,	100,000 †
	£294,212 ‡

Now the total amount of these taxes levied, both in burghs and in counties, is about L.365,000, so that the proportion levied in counties is about $\frac{16}{20}$ths of the whole.

In order to decide whether it is fair that so large a share should fall on the landed proprietors, let the *objects* for which these several taxes are raised be considered. If they are objects in which this class is more particularly interested than any other class of the community; or if the expenses which these taxes go to defray, are occasioned chiefly by the agriculturists, then undoubtedly they ought to bear the greater part of the load. But are the taxes above specified of this description? Not one of them. The land-tax,—it is paid to Government, and is applied to carry on the business of the nation. The rogue-money,—it is levied for defraying the expense of suppressing crime, an object in which all classes have an equal interest. The expense of building and repairing churches, manses, schools, and schoolmasters' houses,—why should these be thrown almost entirely on the landed proprietors?—why should they be saddled with the expense of providing, throughout the land, accommodation for religious worship, and the means of parochial instruction? These, and all the other objects to which the taxes above enumerated are subservient, are objects of national importance,—of catholic utility, and in which the agriculturists

* See Report relative to the Fund for Relief of the Widows and Children of Parochial Schoolmasters for 1835.

† See p. 216 hereof.

‡ In the General Report on the State of Scotland, published in 1814 by Sir John Sinclair, the public burdens on the land-rent of Scotland was then estimated at tenpence in the pound, which would give a total amount of £1,250,000.

are no more interested than every other class of society. With regard to *one* of these objects, there are reasons why they should bear but a small portion of the expense, instead of the whole of it,—we allude to the detection and conviction of criminals. Where is it that crime is chiefly engendered, and that it requires to be most vigilantly watched? Not certainly among a rural population, who possess little to tempt the cupidity of thieves and housebreakers,—but in densely peopled towns, that are filled with merchandise, and goods easily abstracted. And yet there are very few towns,—indeed not more than three or four in the whole of Scotland, which defray the expense of detecting or punishing crimes, even though committed in their bounds. With these exceptions, all the expense of detection, of conviction, and of punishment, falls upon the agriculturists,—though the criminals do not belong to them,—though the crime is not perpetrated against any of their number,—though it is committed not in a landward district at all.

Is there, then, any fairness in obliging the landed proprietors to pay $\frac{1}{2}$ths of taxes, raised to defray expenses which *they* have not chiefly occasioned, and subservient to purposes of national utility? If the class on whom so large a share of taxation is imposed, formed at once the most numerous and the most wealthy part of the population, there might be some reason for this inequality. But what is the fact? According to the census of 1831, the whole population of Scotland amounts to about $2\frac{1}{3}$ millions; whilst those employed in, or connected with, agriculture, amount to only 167,000;* and the whole number of landed proprietors was in 1811 no more than 7798,† and is probably still under 9000!

But perhaps though a fragment of the population, this little band is the most opulent and wealthy. Here again we have to lament the want of accurate statistical information. The only data existing on this subject are afforded by the returns for the income-tax in 1815. The income of the different classes was then attempted to be ascertained, and the following was the result:—‡

* Population Returns for 1831. † Edin. Encyclopædia, art. Scotland, also Sir John Sinclair's General Report.

‡ Article Taxation in Supplement to Encyclopædia Brit.

	Total Income.
Owners and occupiers of land,	L.60,138,323
Owners and occupiers of houses,	27,296,144
Owners of funded property,	30,000,000
Profits and gains of trade,	38,310,935
Salaries, pensions, &c.	11,744,557
	L.178,589,966

In this state there is no separate valuation of the incomes of anded proprietors; but if a half be allowed for the income of farmers and others in the occupation of the soil, there will be left about L.30,000,000 for the annual income of the landed proprietors, being less than one-sixth of the revenue of the whole country.*

With regard to this estimate, however, two remarks occur. In the first place, it is well known that the amount of funded and mercantile property was stated in the returns for the income-tax at greatly less than the truth; and in the second place, since 1815, the increase in the amount and value of *this* description of property, has greatly outstripped the increase in the value of *landed* property. We believe that, if the comparative amount of the incomes derived from landed property, and from all the personal property in the country could be truly ascertained, the former would be found not to be $\frac{1}{20}$th of the latter.

We say, therefore, that it is most unfair to exact from the landed proprietors of Scotland $\frac{1}{2}\frac{9}{0}$ths of the taxes that are levied for the purposes above mentioned;—and the more closely the subject is examined, it will be found to be the more replete with inequality and injustice. The land-revenue of Scotland is, it is true, gradually increasing, though not so rapidly as other kinds of productive stock; and on this account, it might be thought, that the land-owners are enabled the more easily to bear these burdens. But, unfortunately, these burdens are increasing also, and we suspect at a rate which greatly outstrips the increasing value of the land. In 1820 the total number of paupers in Scotland was 44,119, and the expense of supporting them amounted to L.114,195.† Judging from the increase of population, and some other data, this expense cannot now be less

* M'Culloch, on other grounds, estimates the land rent of Scotland at only L.23,000,000, and that too at the present date. (Statistical Account of British Empire, i. 539.)

† M'Culloch's Statistical Account of British Empire, vol. i. 659.

than L.150,000. The number of criminal convictions is increasing still more rapidly—in a ratio far exceeding the increase of population, and which, whether it be owing to greater national depravity, or greater vigilance in the police, renders it necessary every year to levy larger sums of rogue and jail money from the counties. It would be found, if statistical returns on the subject were made, that these particular taxes are increasing in a ratio far greater than the ratio in which the land-rent of Scotland is increasing. Moreover, their increase depends on causes extrinsic to the landed proprietors, and beyond their reach; so that it is not merely a greater burden than is just which they are compelled to bear,—but a growing burden, which every year they are becoming less able to bear.

It is, however, not merely the large and disproportionate amount of public burdens laid upon them *as a class*, of which landed proprietors have to complain. They have another, and a separate grievance connected with the existing system of taxation, which calls no less loudly for reform. We allude to the unequal and absurd manner, in which *individual heritors* are assessed. The correct and only fair method of assessment, is of course to make every person possessing *any kind* of heritable property, contribute,—and at the same time proportion the contribution of each to the *actual value* of his property. But this is not the principle of the existing system. There is inequality, error, and injustice in every part of it—in its principles, as well as in its details.

Most of our readers must have anticipated the point to which we are now alluding, viz. the assessment of heritors according to a valuation of their estates made up about 177 years ago! It will scarcely be credited by those who are not conversant with the beautiful system of Scottish taxation, that every one of the taxes above enumerated, 12 or 13 in number, paid by heritors, are levied from them according to what is estimated to have been the rental of their estates in the year 1660!

It is evident that if a tax is levied from the proprietors of real estates throughout the country, there must be a survey and valuation of the estate of every individual heritor, in order to afford data for fixing the amount of his assessment. Where the tax is one of a parochial nature, it is not necessary that there should be one simultaneous survey and valuation of the

whole country, executed on the same principles, and adjusted to the same standard. A separate valuation in each parish may form the basis of a just and equal parochial assessment, though no one parochial valuation should be executed on the same scale as any other. In like manner where there is a tax imposed separately on shires, it is enough that for the equal allocation of this tax among all the heritors of the shire, there be a valuation applicable only to the property in each particular shire. But where the same tax is exigible from *heritors* throughout the whole country, there must obviously be one general valuation of all the *real* property in the kingdom. Such, accordingly, was the course adopted in Scotland in ancient times, when a general tax, or a "supply" as it was termed, was voted for any public purpose. Even before the reign of Alexander III. (who ascended the throne in 1249), there appears to have existed a valuation of the temporal lands, according to which, subsidies were raised for the national purposes of a civil nature. Of the ecclesiastical lands, a valuation was made in 1275 by a person named Bagimont, who was sent for the purpose by Gregory X. This last valuation, generally known under the name of Bagimont's Roll, was the only one that existed of the ecclesiastical lands, down to the time of Charles II. But this was not the case with the temporal lands. In 1357, great complaints having been made of the inequality of the assessments, in consequence of the change in the relative value of estates, inquisitors were appointed throughout the whole country, in order to ascertain the actual rent or worth of heritable property. These inquisitors held assizes for this purpose, and in 1367 they made up a report, and presented it to Parliament, which set forth both the existing rent according to which estates were in future to be *stented*, and the old rents according to which they had been previously *stented*. The first of these valuations, obtained the name of the *new extent*,—the latter that of the *old extent*.

It would seem that at various subsequent periods, the valuation of 1367 was corrected and adjusted to the changing condition of the country; and indeed no new supply was ever voted by Parliament, without such an adjustment being made. Between the years 1367 and 1643, there is supposed to have been eight separate surveys of the country, with a view to an

equal apportionment of the local burdens,—being on an average, *one* every thirty-four years. What a proof of the close adherence to the first principles of just and equal taxation, which distinguished the legislators of those days! *We theorize* on these principles—our ancestors *practised* them.

In 1643, steps were taken for another valuation, and for comprehending in one roll both the temporal and the ecclesiastical lands. In that year, an act was passed granting a supply of 1,200,000 merks, of which one-sixth was to be contributed by the burghs, and the rest by the shires. The sum of 1,000,000 merks to be contributed by the latter was allocated on them in certain proportions; and in order that the quota exacted from each, should be levied equally from all the heritors thereof, collectors and commissioners were appointed in every shire who were directed

"To use all legal ways to inform themselves, of the *just and true worth of every person or persons, their present years rent* of this crop and year 1643 to landward, as well of lands and teinds, as of *any other thing*, whereby yearly profit and commodity ariseth,"—"and to divide the said roll into particular parishes, by making a roll for every several parish within the said shire, which roll shall contain every particular person's name, sirname, and designation, with their said year's rent and commodity within the said parish."

Though in this way, every one in each county would be equally assessed for the quota laid upon the country, something else required to be done, in order to ascertain whether the proportions laid on the different counties had been equally struck. With this view the act 1643 farther declared as follows:—

"And seeing it is agreed and condescended unto, that the burdens be equally, according to every man's estate, in that case it is declared, that when the haill valuations of the haill kingdom shall be known, in manner and conform to the rolls above-specified,—*therefore*, it is appointed and ordained, that a *survey* shall be made *of the foresaid rolls*, and *compared one with another*, to the effect it may be seen and known, *if any shires have paid more* out of the hundred merks *than other shires have*; and, being so found, that some may be appointed, before this present Convention dissolve, or by the next Parliament, or by committees from either of them, to see *the just proportion* which, according to their foresaid rents, *would fall upon every shire*, that those who have paid more than their just proportion may have payment off the shires which have paid less."

It would appear that this general survey and valuation did not proceed so rapidly as had been expected, and that, at the

same time, there was much remissness in the payment of the tax. Accordingly, in 1645, an act was passed, ordaining the sub-collectors in each shire immediately to pay up the sums deficient, and produce, by a certain day, "the whole valuations of their several shires and parishes thereof, conform to the said act of Convention."

The records of Parliament for the four following years teem with appointments of commissioners for "revaluations," and "rectifying the valuations" of various shires. These valuations, however, were probably neither complete nor satisfactory; for, on the 4th August 1649, a general act was passed, the object of which seems to have been to carry on, arrange and perfect, as far as possible, the valuations previously ordered. As it was more particularly in virtue of this last act, that the valuations that are still used were framed, we will give a few quotations from it. It sets out by stating that Parliament,

"Taking unto their consideration, the many complaints and grievances the within kingdom against the unequality that hath been in bearing public burdens, and being desirous that *all the shires* of the kingdom, and *every person* within the same, may bear *an equal proportion, according to the true worth of their estates*,"—*therefore* have resolved on appointing new Commissioners in each shire, who are required to procure "right and true information of the whole rents of the said shire, and that they proceed, faithfully and impartially, in prosecuting their commission, and the instructions relating thereto," so as "to rectifie and improve, to the best avail, the former valuations." They were specially directed "to take all former valuations into consideration, and *rectifie the same* when they have been unjustly valued; and, where they find that any person hath been undervalued, to augment the valuation of their rent to the true worth, and add the same to the total rent of the shire, and thereby bring the whole rent of the shire to the full value, and also reduce the whole shire to an equality and proportion among themselves; and, in the forming their report, the said commissioners shall set down a roll of every parish," &c.; "and, after the roll of all the parishes are set down, then they are to cast up the total of the valuation of the whole shire." They were also "appointed to set down the total of their former valuation, (which is herewith delivered to the commissioners for each shire, under the clerk-register's hand); and lastly, they are to set down what this valuation to be made, doth exceed the former valuation."—"Farther, the commissioners are to send one from each shire with the said valuation, against the 1st November, which commissioners shall *meet with the Committee of Estates, for comparing the said valuations*, and *perfecting the same*, that they may be a rule for the future, in imposing all public burdens *according to an equal proportion.*"

It was not till 1660 that an entire valuation of the whole

country was completed, in terms of the act just referred to. The important political events which then occupied and agitated men's minds, together with the want of any regular government, would naturally serve to procrastinate and interrupt this measure; and, for the same reason, it is probable that it could not have been conducted with the deliberation and impartiality which were necessary to render it accurate. Notwithstanding these unfavourable circumstances, considerable progress was made, by means of this valuation, towards removing the " unequality in the bearing of the public burdens," which had been made matter of " complaynt and grievance." Data were afforded by it for correcting the proportions to be levied from the several counties, as well as of making a fairer assessment on individual heritors; and, in 1667, when a monthly supply of L.72,000 for one year was voted, *the proportions laid on the shires were very materially different from the previous proportions.* The act by which Parliament voted this supply declared, that it was to be " paid by the several shires and burghs of this kingdom according to *the valuations in the year* 1660, and at the proportions underwritten *respective*, viz." *(Here follows a list of the shires and burghs, with the amount to be contributed by each.)*

In this act, the Scottish Parliament again manifested its anxious desire that no one should pay more than a just and equal proportion of the burden. For though only a few years before a census had been taken of the rent and worth of every man's estate, new commissioners were appointed in each shire, for the express purpose of correcting, where necessary, the rent-rolls. The act directed these commissioners

" To call for and consider the valuations of all lands, teinds, and other real estates within their respective shires and burghs,—and where any complaynt or representations shall be made of the valuations, by any persons concerned, that the valuations are unequal, and that the lands and other real estate and rents within the shires or burghs, are either over or under valued, the commissioners are hereby empowered to hear and determine upon the said complaynts, and upon trial to rectifie all such valuations as they shall find unequal, and to take course that all persons within the shires and burghs be equally and proportionally burdened."

Between the years 1667 and 1690, there were eight acts of Parliament voting supplies, all of which were allocated on the several shires and burghs in the proportions pointed out by the

act we have last quoted, and all of which (except the last) were directed to be levied from individual heritors "according to the present valuations." As a period of rather more than thirty years had elapsed since the existing valuation rolls had been made up, it was thought that some of them might require correction, on account of the dismemberment of properties and changes in the value of land. Accordingly, by the act of 1690, chap. 6, the commissioners in the respective shires were authorized—

"Upon complaint made to them of any inequality in the valuations, either betwixt one parish and another within the same shire, or particular heritor's lands within one and the same parish and shire, to *rectify the same* where they find them unequal; and for that effect to take trial of the valuations in the way and manner prescribed by the act of '1667:' and particularly they ordain that there be a valuation of the shire of *Berwick*, in regard there is no authorized valuation of the said shire *now* extant."*

Whether any general rectification took place in the valuation rolls, we do not know;—but this much we have ascertained, that the proportion of the public burdens which had been fixed, by the act 1643, to be contributed by burghs and by shires (viz. one-sixth by the former and five-sixths by the latter), as well as the proportions which, by the act 1667, had been laid on the several shires, suffered no alteration. In these respects, matters have continued the same down to the present day.

After 1690, no farther proceedings were attempted or authorized by the Scottish Parliament for rectifying the valuation rolls; and in 1707 the Treaty of Union took place, one article of which was, that whenever the sum of L.1,997,763 should be voted by the British Parliament, to be raised in *England* from the proprietors of "land, and other things usually charged there" for land-tax,—the sum of L.48,000 should be raised in *Scotland*, the said sum to "be collected in the same manner as the cess now is in Scotland, but subject to such regulations in the manner of collecting as shall be made by the Parliament of Great Britain."

Then in 1797 the 38th Geo. III. chap. 5, was passed, which ordained a sum of L. 1,989,673 to be levied in England, and a

* In consequence of this injunction, there was a new valuation made up of Berwickshire in 1694.

sum of L.47,954 to be levied in Scotland, as land-tax. The tax thus voted was at first allowed to be levied only for one year, but by the 38th Geo. III. chap. 60, it was made a yearly and perpetual tax.

It was extremely absurd, when this tax was imposed, and more especially when it was made a perpetual charge on the country, not to have taken measures for obtaining a new survey and a new valuation of all the different estates which were to contribute to it. The expense of such a measure, applicable as it must have been not merely to Scotland but to England, would no doubt have been considerable; and perhaps this may have been the chief reason why, at a period when there were so many other more urgent demands on the national purse, this measure was not adopted. There was, under these circumstances, no alternative, but to levy the tax *from* and *in* the several shires, just as it had been levied in previous years.

Having thus explained so fully the date and history of the existing valuation rolls, and noticed the circumstances in which they were made up;—it is scarcely necessary to point out the extreme inequality which must exist in any assessments on real property which may now be regulated by them. There are two separate reasons why they are indeed altogether worthless, for such a purpose. The *first* is their own original inaccuracy; and the *second* is the changes that have taken place in the state of the country and value of property, since they were formed.

What the process was which our ancestors in 1660 adopted for valuing land and other real property, it is not very easy to find out. Whatever it was, we may fairly assume, that it must have been extremely defective. No correct valuation of land can possibly be made, without an exact mensuration of its surface: but we know that no mensuration of any kind could have been made, for otherwise the plans and maps, which are necessary in all land surveys, would have been preserved, or been, at all events, noticed by contemporaneous writers. At that early period, there were no instruments in existence, and far less any persons capable of using them, whereby any such survey could possibly have been made. The probability was, that the values of the different estates, entered in the parish rolls, were mere matter of opinion or conjecture by individuals chosen to specify

both the extent of estates and their value per acre. It is not an unfair presumption if, considering the ignorance, credulity, and partisanship, for which that period of Scottish history was still remarkable, we assume, that valuations constructed on such data, could have been any thing but fair or accurate.

But even although these valuation rolls had ever so correctly represented the rents and values of real estates in 1660, how utterly unfit must they be to represent the rents and values of the same estates in 1837! It is true that if every person's estate, entered in these rolls, had been since improving in value, *in exactly the same ratio*, they would still afford a correct basis for assessment, though not representing the full amount of their present rental or annual value. But it is hardly necessary to observe, that in an interval of 177 years, numerous causes of improvement and of deterioration respectively, must have sprung up in some districts, and not in others,—calculated to effect an entire derangement of the original proportions; so that a particular estate, which in 1660 may have yielded precisely the same rental as another in the same county or parish, may now yield a rental even so much as ten times more or ten times less, than that other.

But this is not all. Since the time that these valuation rolls were made up, *some properties* which were entered in them, *have ceased to exist*,—whilst others have *come into existence*, which of course do not appear in them at all.

It has been seen, from some of the acts we have quoted, that it was not merely *land* that was intended by the Scottish Parliament to be assessed, but "lands, teinds, and *all other real estates*, within the respective shires;"—and accordingly the valuation rolls are found to comprehend, besides lands, teinds, and feu-duties,—*corn-mills*, *malt-mills*, *bleach-fields*, *gardens*, &c. Now it is hardly necessary to observe, that almost the whole race of such subjects as existed in 1660 have long since disappeared, though the properties on which they were situated, are assessed at the same rate as before. On the other hand, an enormous amount of property of a similar description has, since the year 1660, risen up in several parts of Scotland. If it contributed its proper share of the taxes exigible from real property, great relief would be afforded to those who have to bear the

whole brunt of taxation in Scotland. Look at the immense revenues which, in some parts of the country, are now drawn from coal, iron, lime, slate, alum, and other useful minerals.* Look at the prodigious incomes of other landed proprietors who have erected distilleries, and manufactories of various kinds on their estates. Look at the increased value of land in many districts, which have become studded with densely peopled villages, affording ready markets for agricultural produce. These sources of national strength and private affluence have undoubtedly flowed out upon the country, more profusely in some parts of it than in others; and served to alter, accordingly, the relative wealth and income of its several counties. But the same result may be brought about by a retrograde as well as by a forward movement; and though fortunately for the country, there has been, on the whole, vastly more of improvement than of impoverishment, there can be no doubt that, owing to the decay of towns, the suppression of monasteries, and the fluctuations of trade and population, there are some districts which are now actually of less value, than they were two centuries ago.

From these various considerations it must be manifest, how utterly inaccurate and fallacious the old valuation-rolls must be, when used in the present circumstances of the country as a

* The following has been stated to have been the annual value of the most important mineral productions in Scotland in 1815.

Coal,	L.833,333
Lime,	375,000
Iron,	229,320
Lead,	130,000
	L.1,567,653

But to this great additions must be made, in order to represent the present annual value. The quantity of iron now annually produced in Scotland is 88,000 tons, which, at the moderate rate of L.6 per ton, would yield L.528,000 a-year; but one-third must be added to this, for the conversion of a part of this into bar-iron; so that the annual value of the iron manufactories in Scotland cannot now be stated at less than L.670,000,—treble what it was in 1815. A still greater increase has taken place in the consumption of *coal*, and about as much in *lime*; so that we cannot be far wrong in estimating the present annual value of the above mineral productions in Scotland at L.4,500,000. What the annual value of *all* the mineral productions would be, we have no means of ascertaining.

basis of taxation. For not only do they not represent the true value of the properties to be assessed, but they omit probably one-third at least of the property which is assessible.

On every account, it would be desirable to test the truth of these remarks by some statistical returns which could be relied on. It is to be regretted that since 1814–15 (the last year of the property-tax) there is no information of an official character either regarding the value of real property in Scotland, or regarding the amount and nature of the burdens to which it is subject. There are such returns for England even of so late a date as 1833, and extending back a good many years. These returns were made to Parliament with the view of shewing the actual amount of the burdens sustained by the owners and occupiers of the soil in that part of the empire, so as to justify their application for relief. These returns had the desired effect, by inducing Goverment to recommend to Parliament to vote yearly about L.100,000 in aid of the English county rates. We trust that, with so strong a precedent before them, the Scotch members will in the next session of Parliament, with the same view, move for similar returns applicable to Scotch counties.

But though we are thus, for the only official information existing on the subject, thrown back on the old property-tax returns, they serve sufficiently well for our present purpose to shew the grossly unequal way in which at least some of the taxes on landed proprietors are levied, and moreover help us to calculate the amount of that inequality.

The following table has been constructed for this purpose. The first column gives the names of the Scotch counties, arranged according to the amount of land-tax which each respectively pays. The second and third columns shew the amount of land-tax originally laid upon each county, and still payable. The fourth shews the amount of property-tax which in 1811 was paid by the whole real property of every kind (*except houses*) in each county; and in order to exhibit more clearly how widely the assessments for *land-tax* vary from the order of *real value*, there has been another column prefixed to the table, in which, opposite to each county, is placed the figure representing where it would stand, if each county were to pay according to *its true value*.

		Land Tax,*		Property Tax paid in 1811. †
		Original.	Unredeemed.	
1	1. Perth, ...	£3334	£2222	£460,739
3	2. Fife, ...	3275	2322	335,291
8	3. Aberdeen, . .	2715	2017	233,827
2	4. Ayr, ...	2574	1672	336,472
10	5. Roxburgh, . .	2452	1389	230,663
6	6. Forfar, . . .	2177	1013	260,197
5	7. Mid-Lothian, .	2117	1563	277,828
4	8. Lanark, . .	2056	1628	298,019
9	9. Berwick, . .	1870	1199	231,973
14	10. East-Lothian, .	1850	1164	180,654
7	11. Dumfries, . .	1804	1183	246,002
12	12. Argyle, . . .	1295	838	192,074
15	13. Stirling, . .	1166	670	177,499
13	14. Kirkcudbright, .	1113	614	192,047
17	15. Renfrew, . .	900	720	127,069
11	16. Inverness, . .	824	782	195,844
19	17. Ross, ...	819	690	91,090
20	18. West-Lothian, .	778	455	82,947
21	19. Banff, . . .	765	516	79,396
22	20. Elgin, . . .	704	452	62,312
23	21. Peebles, . .	693	357	57,382
18	22. Wigton, . .	668	511	123,837
16	23. Kincardine, . .	654	383	159,896
25	24. Selkirk, . .	601	403	39,776
24	25. Dumbarton, . .	508	280	56,973
33	26. Orkney, . .	482	395	9,495
27	27. Caithness, . .	398	312	30,926
34	28. Shetland, . .	241	220	6,741
26	29. Clackmannan, .	234	199	32,048
28	30. Sutherland, . .	223	188	28,457
30	31. Bute, . . .	204	202	18,591
29	32. Kinross, . .	181	148	2,753
31	33. Nairn, . . .	167	167	11,726
32	34. Cromarty, . .	142	142	10,860
		£39,984	£27,116	£4,816,577

This table, imperfect as it is, shews in a very striking manner, how great, even in 1811, was the inequality of the assessment for the *Land-tax*. Aberdeenshire, for example, though its real rent is *one-fifth less* than that of Lanark, pays *one-third more* land-tax than Lanark. The real rent of Roxburghshire is about *one-tenth less* than that of Dumfriesshire, and yet it pays about *one-third more* land-tax than Dumfries. The real rent of Inverness is considerably *greater* than that of Haddington, and yet it pays not *one-half* of the land-tax which Haddington pays.

* The sums in these two columns were furnished to the writer of this article in August 1837.

† The sums in this column have been taken from M'Culloch's Statistical Account of the British Empire, xvi. 540.

The real rent of Fifeshire is *not so great* as that of Ayr, and yet it pays *a third more* of land-tax than Ayr. The real rent of Banff is not so much as *one-half* of that of Kincardine, and yet Banff pays considerably *more* land-tax than Kincardine.

But the last column in the foregoing table wants an important ingredient, which would make a material difference in the valuations of the counties. The property-tax that was paid for *houses*, *mills*, *factories*, &c. in the several shires, is not included in the sums set down in that column; they show the assessment merely on *lands*, *mines*, *quarries*, *&c.* The property-tax returns that are preserved* and published, unfortunately do not separate the assessments on houses in royal burghs, from the assessments on houses in the shires. It would therefore have been incorrect to have engrossed into the valuation of the shire in the above table, the value of the houses in royal burghs which are not liable for the share of the land-tax contributed by counties. A considerable addition must therefore still be made to the sums in the last column of the above table, *on account of buildings*; and this addition will obviously be greatest in those counties where population and manufactures have made the greatest strides. But these, in nine cases out of ten, are precisely the counties, which, on account of their abounding in *mineral* products, appear from the *above table* to have risen in the scale of value; so that the additional amount of land-tax, which the above table shews ought to be contributed by such counties as Lanark, Dumfries, Inverness, Ayr, and others, would be still farther augmented by the consideration now alluded to.

But the valuations in the above table were made *twenty-seven years ago*,—since which, as already shewn, there has been an enormous addition made to the value of all real property connected with manufactures. If a table, such as the above, could be constructed applicable to *the existing* values of all real property in the several counties, we are satisfied that, instead of its appearing that some counties paid only three and four times the amount of land-tax which they ought to pay in comparison of others, it

* We cannot help thinking it was a very injudicious and unnecessary step, on the part of government, to order all the detailed returns under the property-tax to be destroyed. We have heard it surmised, however, that the Scotch returns were, privately and secretly, saved from destruction. We hope that the fact is so.

would be shown that the inequality and disproportion are nearly double this.

In the preceding observations, we have endeavoured to show the changes that have taken place in the relative rentals of *counties*. We believe that were a similar comparison instituted as to *parishes*, in the same county, the inequality would be found to be far greater;—and if the process were extended to the properties of *individual heritors* in counties or even in the same parish, the result would be found still more striking. In the case of counties, the chances of alteration in value are confined to thirty-four members;—in the case of individual estates in each shire, there may be three or four hundred, all liable to be affected, so that, in the latter case, the extremes of change would necessarily be greater. Besides, what may be sufficient to double or treble the value of an *estate*, is not likely to have the same effects on a *parish*, still less on a whole *county*; and, for these reasons, it is obvious, that if some *counties* pay six or seven times as much land-tax as they ought to pay, many *landed proprietors*, in the assessments made on them for land-tax as well as for county taxes and parish-rates respectively, are made to pay *at least twenty times as much as they would pay*, if every one were assessed only *according to the true value of his property*.

Are we not fully warranted, then, in saying, that the system by which the public burdens are levied in Scotland, is full of error, absurdity, and injustice, and that it is a national disgrace that such a system should have been allowed to continue so long? It is matter of astonishment, that the Scottish landed proprietors have been so submissive and quiescent under a yoke, which, whilst it operates injuriously and oppressively on individuals, tends also unfairly to depress and weigh down the agricultural interests of Scotland.

The same yoke is not laid upon the neck of landed proprietors in any other part of the empire. In England, neither land-tax, nor county-rates, nor parish-rates, are levied according to valuation-rolls a century and a half old. This *was* the case however, until the year 1815, when an act, the 55th Geo. III. ch. 51, was passed, which appointed that in future all county-rates as well as parish-rates should be assessed in England, *according to the true or real annual value of the subjects liable.* By

the recent Poor-law act of England, it is still more explicitly declared, that "*no rate shall in future be allowed* for relief of the poor, *which is not made on an estimate* of the several properties rated thereunto,—that is, of the rent at which the same might be reasonably expected to be let, free from all rates and taxes, and deductions therefrom being made of the cost of repairs, insurances," &c. Power is also, by the same act, given to the central board of Commissioners to cause a survey and valuation to be made of all real property in the several parishes. So that in England, the bridge-money, gaol-money, salaries of constables, expense of prosecutions, poor's-rates, &c. are all levied equally and proportionally, according to the actual value of the properties liable.

And what is the description of property liable?

With regard to the *land-tax*,—that question may be best answered by an extract from the 38th Geo. III. c. 5,—the act which originally imposed it on Scotland as well as England. It declares, that in English counties, the land-tax shall be levied, on "all manors, messuages, lands and tenements, and also on all *quarries, mines of coal, tin, and lead, copper, mundic, iron, and other mines;—iron-mills, furnaces, and other iron-works;—salt-springs and salt-works;—all alum mines and works;* —all parks, chaces, warrens, woods, underwoods, coppices;—and all fishings, tithes, *tolls, annuities, and all other yearly profits;*—and *all hereditaments of what nature or kind soever they be,* situate, lying and being, happening or arising within the several and respective counties, cities," &c.—"and all persons, bodies politic, &c. having or holding any such manors, messuages, lands, tenements, hereditaments or others the premises, in respect thereof, shall be charged with as much equality and indifference as is possible, by a pound-rate, for or towards the several and respective sums by this act imposed."

With regard to county and parish rates, they are, by the 55th George III. ch. 51, appointed to be levied *from the same subjects which are liable to be assessed for the poor-rate,*—that is, real property of every description, including not merely lands, but mines, quarries, dwelling-houses, breweries, manufactories, and all other buildings. The whole county and parochial rates levied in England and Wales amounted, in 1833, to L. 8,606,501, of which L. 5,434,890 was raised from land;—the rest (between ½ and ⅓) being contributed by the owners of houses, factories, mills, and manorial profits.

Why, then, are the public burdens in Scotland, both county-rates and parish-rates, not levied in the same way as in England? If they were,—one great grievance would be removed;—the

burden, heavy as it is which is laid on real property, would then be borne fairly and equally by all the owners of it, and relief to the extent of one-third or one-half, would in consequence be afforded to that class which, at present, sustains the whole weight.

But this is not the only relief which a reference to the English law suggests. Many of our readers are perhaps not aware that, in order to make up the land-tax levied from the English counties, it is not merely *real property* which is assessed, but the personal estates of such as are resident in the counties. The 38th Geo. III. ch. 5, enacted, that for every L. 100 of income arising from goods, merchandise, or other personal property, a tax of 20s. should be levied; and for every L. 1 of pensions and annuities 4s. should be levied;—*the rest* of the quota of the tax being appointed to be made up by a charge on the real property situated in the district. The Commissioners of each shire were, by that act (as in the old Scottish acts) directed to allocate the quota laid on the shire among the several parishes composing it; and in these parishes assessors were appointed to levy the particular sums so allocated, by a "charge respectively upon *all ready money, debts, personal estates, offices, employments, annuities, and pensions*, chargeable as aforesaid, according to this act, and by an equal poundage upon all manors, lands, tenements, rents, hereditaments, and other the premises, within the limits, circuits and bounds of the respective parishes," (section 8.) This enactment, of course, relieved the real property in English counties, of a very considerable portion of the land-tax.*

This leads us to observe, that precisely the same arrangement existed in Scotland during the time of the Scotch Parliaments. The tax which was laid upon real property under the old land-tax acts, formed only a part of a general imposition *on property of every description*. Latterly, the tax levied from owners of personal property was paid directly to the Government, alongst with the tax levied from owners of real estates. This personal tax was called Pole-money. But at first, it was paid to the owners of real estates, in order to relieve them of part of the burden. The act 1667, for example, which granted to the King a subsidy of L.72,000 monthly for twelve months, bears, that

* The same rule exists with regard to church-rates in England. It is not merely real or heritable property which is liable to be assessed for them, but personal property also.—(*Burn's Justice of the Peace*, i. 590.)

"The King's Majesty considering, that the land and real rent of the kingdom is liable to his Majesty for this supply, and that the said land-rent is under many other great burdens; and his Majesty being desirous *to ease the same* as much as possible, doth therefore, *and for relief thereof*, with advice of his estates, statute and ordain, that *all persons, inhabitants within the several shires*, past sixteen years of age (excepting bishops, noblemen, barons, heritors, liferenters, &c., bearing burden for their real estates, schoolmasters, &c.) *be taxed, and pay unto the heritors and others liable for real rents* under whom they live, and for their relief, the sums of money after mentioned, for this year 1667, viz. each gentleman above the quality of a tenant, the sum to be appointed by the heritor, not exceeding L.6 Scots, for himself, his wife and children," &c.

Subsequently, instead of obliging the heritors to reimburse themselves by applying in this way to those who had not to pay as owners of real property, Government itself levied a part of every supply from this class. In June 1695, a subsidy was voted by Parliament;—one part of it was laid on real property, and the rest on personal property. Two acts were passed for the purpose,—the one authorising a specific sum to be levied from the land, the other authorizing an assessment on personality, according to its amount. Both acts were passed within a few days of each other, and they both, in their narrative, allude to the dangers which threatened the kingdom, "and the continuance of the present war, which visibly require the keeping up of the standing forces, and the supplies necessary for their maintenance." Moreover, the *one* act refers to the *other*,—so that there can be no doubt that the taxes imposed by each, were intended to form parts of one general taxation,—a sort of income-tax—in order to supply Government with what was necessary for the public service. By the last mentioned Pole act, merchants, traders, and others, whose free stock and means were between 500 and 5000 merks, were to pay "L.2, 10s. of Pole;" and those whose stock was between 5000 and 10,000 were to pay L. 4, and so on.

In the subsequent years, no act was passed for a new supply, to be levied on the land-rent, without a Pole act being passed simultaneously with it, authorizing a portion of the supply to be levied from personal property.

Founding, on these authorities, and on the practice in Scotland down to the time of the Union, as well as on the practice in England since, we say, that when the British Parliament in 1797 resolved that a supply of L.47,954 was to be raised in

Scotland, as formerly, for the service of the state, a part of that sum ought to have been laid upon the owners of personal property, and not exclusively on the owners of real property.

In addition, therefore, to all the other considerations previously adverted to, the landed proprietors of Scotland may, on the ground of the laws, constitution, and usage of their country, plead their right to be relieved of a part of the land-tax.

We are not sure whether a similar inquiry into the ancient laws and practice of Scotland, in regard to several others of the taxes now paid by owners of real property, would not shew, that formerly these taxes were neither intended to be levied, nor were in fact levied from *heritors* exclusively.

We have not space at present to do more than refer to two taxes. The *rogue*-money was created by the 2d Geo. I. chap. 26, and by the 12th section thereof it was provided, that in order to provide "a sufficient fund for defraying the charges of apprehending criminals in North Britain, and of subsisting them when apprehended until prosecution, and of carrying on the necessary prosecutions against them," it should "be lawful to and for the freeholders of every shire, county, or district in North Britain, *to assess the several shires or stewartries* where their estates lie, at their meetings at any of their head-courts yearly, in such sums as they shall judge reasonable and sufficient for the purposes aforesaid." There is not one word in the act requiring the old valued rent to be taken as a basis for the assessment, or even confining the assessment to proprietors of *land*. That this particular tax, if it is to be levied exclusively from heritable property, may be legally levied from all descriptions of heritable property, and according to the real rent, we have the highest authority for stating; because in January last, a joint opinion to that effect was given by the present Dean of Faculty and Solicitor-General, on a case submitted to them by the county of Lanark.

The other tax which we allude to, is one of a parochial nature—for building and repairing *churches* and *church-yard walls*, &c. Mr Dunlop observes, that the act (1563) which created this tax (and it is the only act existing on the subject), "in regard to the expense of the two-thirds imposed on the parish, directs that it should be laid on the *parishioners*, and according to their substance. But it is *now* (he says) perfectly settled in

practice, that *the whole* expense is to be borne by the parish; that it is to be paid, *not* by the parishioners at large, but only by the *heritors* or proprietors of heritable property, and that not according to their substance, but according to the value of their landed properties." He in a foot-note quotes the words of the act, which certainly give no countenance whatever to the existing "*practice*." It directs sheriffs "to pass and charge *the parishioners* of the parish kirks within this realm, to elect and chuse certain of the most honest qualified men within their parochines, to tax *every one of them*, effeiring to their substance, *for furnishing* of the two parts of the *expenses* to be made in *bigging* and *repairing* of the said parish kirks."* We ask where is the authority in this or any other existing act, for saddling exclusively such parishioners only as may be possessed of *heritable* property, with the payment of this tax?

It is proper to mention, with reference to this tax, as well as poor's rates, that by recent decisions of the House of Lords and Court of Session it has been found, that if a majority of the heritors resolve on altering the mode of assessment, they may be levied according to the real rents and not the old valued rents. This is undoubtedly an advantage so far,—though we think it ought not to be in the power of a majority to reject it. It may be the interest of an arbitrary majority, to continue the system of unequal assessment.

We feel that we have now said enough to shew the illegal and unconstitutional character of some of these burdens, as well as to prove the inequality and injustice which pervades the whole system. To *reform* that system would be much too tender an operation,—it should be abolished and extirpated entirely; and there should be substituted in its stead, a system of taxation suited to the present state and income of the country, and constructed on principles of common sense and common fairness. Why should the old valuation-rolls be any longer adhered to? They were framed *in order* (as the act of 1649 declares) "that all *the shires* of the kingdom, and *every person within the same*, may bear an *equal* proportion, *according to the true worth of their estates*." By levying, therefore, our taxes, according to these ancient rolls, we are actually defeating and perverting them from the purpose for which these rolls were constructed.

* Dunlop on Parochial Law, p. 6.

The observations we have already offered will at once suggest the leading principles on which the public burdens in Scotland ought to be allocated and levied. As they are applicable to objects in which all classes of society have a common interest, they ought to be borne and sustained by all in common, instead of being accumulated on a particular class, neither the most numerous, nor the most wealthy, nor the most prosperous in the country. Let the ancient practice and law of Scotland be revived, of obliging all persons, whether possessed of heritable or of movable property, to contribute "effeiring to their substance." If it be said, that it would be difficult to ascertain the incomes of individuals possessing merely movable estates, the answer is, that such difficulties were got over under the property-tax acts, where there was far greater chance of such difficulties being started. Moreover, in many parishes at this moment, and for years past, the poor's rates have been collected, one-half from real property according to its real rent, and the other half from personal property according to its actual income,* without either difficulty or dissatisfaction; and we do not see why all other taxes, whether parochial or county, might not be levied in a similar manner. We have already explained, that if such an arrangement were to take place, the relief to landed proprietors as a class would be to diminish their burdens by three-fourths at least, and that many individuals would pay one-tenth or even one-twentieth of what they pay at present.

In the event of its being found impossible to impose a part of these burdens on personal estates,—the next best remedy would be to make all real property—of every kind situated in the several shires and parishes contribute;—and contribute according to its present value. There can surely be no difficulty, whether practical or political, in applying this remedy, and its effect would be, to relieve the present tax-payers, as a class, probably to the extent of one-half.

Whichever of these two plans of relief and redress be adopted, there is one measure equally necessary in both cases so as to equalize the assessments on real property,—and that is, a *correct valuation of it*. There are three ways of accomplishing this; (1.)

* In Glasgow, Greenock, Dundee, and the landward parishes of Cargill, Kilbarchan, besides others, an assessment for poor's rate is laid on the inhabitants or parishioners according to their means and substance. No difficulty has been found in these cases, of ascertaining the incomes arising from personal property, near enough at least to make out an equal scale of assessment.

by causing every *parish* separately to make a valuation of the property situated in it; or (2.) by causing each *county* to make a valuation of the property within it; or (3.) by appointing persons to make a general valuation of *the whole country*. The last method is in many respects preferable to the other two. It would be the least expensive,—it would be the most correct,—and it would relieve proprietors in parishes and counties, from a duty which might create among them much disagreement.

The cost of such a valuation would not be very great. Calculations have lately been made by persons of the first experience and ability, of the expense of valuing land in England for the commutation of tithes. Their estimate was from 1d. to 3d. per acre. As there are 18,944,000 acres of land in Scotland, this would give a maximum of L.236,670 for a general valuation of the country. But in Scotland, there is much more waste and barren ground than inEngland;—in the former no less than $\frac{7}{10}$ths of the whole is waste, in the latter only $\frac{1}{10}$th; so that in Scotland the labour and difficulty of valuation would be five or six times less than in England. On this account we may assume, that the expense of valuing the landed property of Scotland would not exceed L. 50,900. But as there must also be a valuation of house property, the whole expense might be reckonedat L.100,000, being about only one-third of what we have supposed to be the amount of a year's taxes paid by landed proprietors.

We may add, that a most favourable opportunity now presents itself for such a valuation of the country. The trigonometrical *survey* of Scotland is to be resumed early next year; and the valuation might go on simultaneously with it. In Ireland, with a view of equalizing the assessments for county rates, a valuation was in 1825 directed by Government to be commenced, in consequence of a recommendation of a Committee of the House of Commons. But a valuation could not be effected without correct maps; and therefore a trigonometrical survey, at the expense of Government, was undertaken of that country. Maps of several of the Irish counties have already been published, and a valuation founded on them has been nearly completed, which, so far as it has gone, has given the most entire satisfaction. Both the survey and the valuations are conducted by officers appointed by Government. The latter before being

finally adopted and recorded, are made public, so as to give the fullest opportunity for correction and adjustment.

It would not be necessary, however, that the valuation in Scotland should be on the same minute scale as in Ireland. The county rates there being paid primarily by *occupants* of property, it is necessary to have a valuation, and of course a survey, which separately represents not only every house, but every field and enclosure in the country.* As the county and parochial rates are in Scotland exigible from *owners*, and not from occupants, it would be necessary that the Scotch valuation should apply only to estates, and therefore it is unnecessary that the maps should represent more than the boundaries of estates. The expense, therefore, of a survey and valuation of Scotland would not be one-tenth of the expense necessary for the same extent of country in Ireland; and, of course, the scale of the maps may be considerably less. We should think that, if constructed on a scale of three inches to a mile, they would be sufficiently large to exhibit all the information that could be desired.

If, therefore, the landed proprietors of Scotland are anxious to be relieved of a portion of the burdens imposed on them,—if the agricultural interests generally wish to have removed one undoubted cause of their present depression, let them represent their case to the British Legislature, and we feel satisfied they will obtain redress. Both Houses of Parliament are already pretty well aware of the unjust proportion of public burdens which landed proprietors have to sustain. Three or four years ago, committees were appointed, both in the House of Lords and in the House of Commons, to consider the subject of English county rates. They reported that an undue proportion of public burdens was borne by landed proprietors. Her Majesty's present advisers concurred in that opinion; and they accordingly resolved on relieving them to the extent of about L.100,000 yearly. They in August 1835 proposed a vote of L.110,000, in order "to defray certain charges hitherto paid out of the county rates." The particular purpose to which it was announced by the Chancellor of the Exchequer, that this vote would be applied, was the expense of county prosecutions. Joseph Hume, as might have been expected, made objections to the proposed grant; to which the Attorney-General replied, "I cannot see

* The maps of the Irish survey are on a scale of six inches to the mile.

why *the landed proprietor* is to be considered as more interested in bringing public offenders to justice, than *any person who is possessed of personal property*."* The same observation applies with no less force to the expense of detecting and prosecuting and alimenting criminals, which is borne by Scotch counties;—and not to that tax alone, but to all the other public burdens, which in Scotland are imposed exclusively on landed proprietors. Since 1835 there has been annually voted a similar sum, to relieve landed proprietors in England of a part of their burdens,—though, as the relief is given by payment out of the national revenue, it has the effect of throwing some additional burden on the rest of the empire.

We may add, that the case of the Scotch landed proprietors is in many respects a much harder one than the English; for not only are they not relieved of any part of their burdens, as the latter are by an assessment on personalty, but they have a greater number of taxes to pay,—as, for example, the expense of building schools, manses, providing schoolmaster's salary, &c.†

We observe that the subject which we have been discussing in this article, has already begun to excite the attention it deserves in Scotland. The county of Lanark, in February last, appointed a committee to consider the subject; and they framed a report, which very ably points out the immense extent of *real* property in that county, which at present pays none, or next to none, of the public burdens. But it was the opinion of the committee, that something more was necessary to be done than a measure of relief for the landed proprietors of Lanarkshire.

"It has occurred to this committee (says their report), and it is believed is in accordance with the opinions of many noblemen and gentlemen in the county of Lanark, that the proposed measures should be adopted *generally throughout Scotland.*"

This suggestion was approved of by the county, and at a Gene-

* Mirror of Parliament for 10th August 1835.

† We may here observe, that though there is no obligation in Scotland, any more than in England, to build new churches, unless the old ones are too small or in decay,—in England much greater aid has been given by Government for the erection of new churches than in Scotland. In 1818 an act was passed authorizing the erection of chapels of ease in populous towns and extensive parishes in England. By a return made to Parliament during last session, it appears, that, since 1822, 219 chapels have been erected,—9 are now in progress,—and 51 more under the consideration of the commissioners. The Parliamentary grants for these amount to L.1,481,689. In consequence of the erection of these 279 chapels, there will be of course so much the less occasion for enlarging the old churches,—in consequence of which the English landed proprietors have benefited immensely in a pecuniary view.

ral Meeting of the Commissioners of Supply, held on the 1st May 1837, *Lord Belhaven* in the chair, a resolution was adopted in the following terms :—

"That the burden of the rogue-money, bridge-money, and other county and local taxes, has been hitherto borne almost exclusively by the landed proprietors of Scotland, and it is reasonable and has become indispensable, that *these and all similar assessments and taxes* upon the counties of Scotland, should in future be imposed upon *the whole real property of every description*, within such counties respectively."

Another resolution was adopted, re-appointing the committee, and directing them to frame a Bill which might be introduced into Parliament

"with full power to them to correspond with the conveners of the other counties of Scotland, and to endeavour to induce as many of them as possible to co-operate in having a *general measure carried through Parliament for the more equal distribution of all general and local taxes*, which are now or may come to be imposed upon any of the said counties."

Another public body which has lately advocated the necessity of a re-valuation of real property in Scotland, is the Convention of Royal Burghs. At their annual meeting in July, they took into consideration the Bill for New Prisons which was introduced into Parliament last session and read a second time. By this Bill, a Commission is appointed, which is to have the charge of the whole prisons in Scotland, as well as the treatment of the prisoners. They are authorized also to levy a sum not exceeding L.30,000 a-year, to defray the expense of building and maintaining prisons, alimenting prisoners, &c. * This sum is to be levied from proprietors of land and houses exclusively,—from the former according to the *old valued* rent,—from the latter according to the *real* rent. The following was the resolution come to by the Convention, regarding the proposed mode of levying the necessary funds :—

"That as it is the first principle of all *Governments, to provide for the prevention and punishment of crime*, the expenses of building and repairing jails and the aliment of prisoners ought to be defrayed *from the general revenue*, and not by a partial tax on *real property alone* :—that should it be impossible to get these expenses from the consolidated fund, a tax should be laid on lands and houses, according to their *real value* and in the most equitable mode, and with this view *a new valuation should be made of all lands and property in Scotland*."

In the spirit of this resolution we entirely agree, and think that it is applicable not merely to the expenses to be incurred for building and maintaining prisons, and alimenting criminals,

* Mr Hill, the inspector of prisons, states in his report, that a sum of L.52,000 will be necessary, in order to provide additional accommodation for prisoners in Scotland.

but also to the expense of criminal prosecutions, the expense of building and maintaining churches, schools, &c., and to all the other public burdens which are at present exacted from landed proprietors.

The only objection we have heard stated, or rather anticipated, against an equalization of these burdens, is, that the effect would probably be to lay upon some properties which at present pay but a small share of the land-tax and other public burdens, a somewhat larger amount of taxes, and that as these properties have been purchased or have been improved, on the faith that no such increase would be made, it would be doing an act of injustice to increase the burdens on these properties. But to maintain such a proposition as this, would only be an abuse of terms. The grand principle of justice and the first maxim of fair taxation is, that every subject should contribute to the support of the state and of the national institutions according to his means; and any individual who happens to be assessed in a sum less than what he ought to pay according to that principle and maxim, and who wishes to keep his assessment at that unequal amount, is in truth attempting to do injustice to others for his own emolument. He is certainly not entitled to do this; and as little can he be allowed to justify such an act, by alleging that he reckoned upon the continuance of this system of inequality and injustice. If such an argument were to be admitted, there would be a stop put to improvement of every kind; for no measure of general and national benefit can be introduced, without injuring, directly or indirectly, some individual interests.

We have extended our remarks on this subject to a much greater length than we intended; and though there are still many collateral views which occur to us calculated to shew the vast importance of it to Scotch landed proprietors, and to the agricultural interests generally, we will now conclude for the present. But we cannot do so without giving a strong and earnest recommendation, that at the general meetings of the landed proprietors which will take place in the several counties for the Michaelmas Head Courts in October next, the subject should be warmly taken up, and committees appointed to act in conjunction with the Lanarkshire committee, for the adoption and accomplishment of common measures.

ON THE PREPARATION OF LIVE-STOCK AND MEAT IN REFERENCE TO THEIR EXPORTATION BY STEAM-VESSELS.

Steam-Navigation has already attained the object of its invention, to a greater degree of perfection than steam-locomotion by land on railways or roads. This perfection is, no doubt, in a great measure, to be ascribed to the favourable nature of the element upon which steam-navigation is practised, —water presenting a level surface favourable to locomotion. The great specific gravity of water too, enables it to float a capacious vessel, containing within itself the motive power and the objects carried, as near as possible to the centre of gravity of the whole mass,—presenting a combination of arrangement highly favourable to its locomotion; and yet, notwithstanding these circumstances, so favourable to locomotion on the water, the speed acquired by steam-carriages on railroads has much exceeded that attained by steam-vessels. Twenty-four miles per hour have been accomplished by steam-carriages fully loaded, on level railways;* whereas the highest rate of sailing by steam-vessels with full cargoes, has seldom, if ever, exceeded thirteen miles an hour. This comparative slow rate of steam-vessels may easily be explained, on the principle of resistance which, in their progressive motion forwards, they have to encounter in displacing an element of so high specific gravity as water; whereas steam-carriages have only to displace the light attenuated air. This difficulty steam-vessels can never fully overcome. But the recent experiments with passenger-boats on canals, whose construction in avoiding friction has enabled them to increase their velocity to ten miles an hour, with a small moving power; and those constantly making on the form of paddle-wheels, reasonably inspire steam-navigators with the confident hope of discovering an improved form for steam-vessels, which will acquire a higher velocity with a diminished moving power, than they have ever yet attained;† whereas the impossibility of constructing

* Higher velocities, we are aware, have been accomplished on the Liverpool and Manchester Railway in short distances; but we question that trains of goods have ever been propelled 24 miles in the hour.

† Could means be discovered of decomposing water easily, the ocean would

railways generally so level as water, and of dispensing with the use of wheels of small diameters in steam-carriages, compared with those of paddle-wheels, together with the bounding motion forwards of wheels at high velocities on railways, present almost insuperable barriers against steam-carriages attaining a much greater increase of velocity. The compact bulk of steam-vessels carrying large weights compared to those of steam-carriages with their lengthened trains, and the enormous expense of laying double lines of railways with offsets, amounting to L.50,000 a-mile, will ever render steam-navigation a mode of conveyance, whose cheapness for goods more than overbalances the advantages of higher speed on railways. To this advantage should be added, that of steam-vessels finding at all times, an easy, ready-made access, into every port on the coasts of all maritime nations.

These circumstances have hitherto enabled, and, we think, will still continue to enable, steam-navigation to confer benefits on agriculture, to a much greater degree than steam-locomotion on railways. One of these benefits is, that of conveying live-stock and slaughtered meat to markets in distant ports with expedition and safety. These and other products of the farm are sent weekly to the English markets from various parts of Scotland, and the more distant the part is situated from the English markets, the greater the benefit does steam-navigation confer upon it. Eggs, poultry, and other produce, are now reared and collected in the Western Isles for Glasgow and the markets on the English coast, and, were the railroads completed betwixt Liverpool and London, it is not improbable that fresh Loch-Fyne herrings may be served up on the breakfast table in the metropolis every morning. But it is Ireland which has derived the greatest benefits from steam-navigation, benefits which no system of railways could have conferred upon it; for, but for it, the markets of England would be as inaccessible now, as they formerly were to Irish farm-produce. The importance of such markets may be inferred from the amount of farm-produce from Ireland, annually imported into the principal shipping ports on the west coasts of England and Scotland from Glasgow to Bristol, and which almost exceeds belief. It is pleasing to the patriot to be assured, that this great increase in farm-produce has not arisen

afford to vessels an inexhaustible supply of hydrogen gas, of high elastic powers, and of oxygen, the supporter of light and heat.

from increased privation to the peasantry of the necessaries of life, but from actual improvement in the fertility of the soil, attained by superior modes of culture, and from the happy change effected by the farmer in directing his attention more to the cultivation of live-stock, which the humid and mild climate of Ireland is better capable of rearing, than crops of corn successively for years on the same ground.

The intercourse between Ireland and Britain, which steam navigation has encouraged and established, has not failed to impart activity, just dealing, and knowledge of the world to the Irish character. Formerly, it was thought enough by the Irish farmer to prepare small quantities of grain, butter, or salted provisions for the dealer who went his rounds at stated periods, and who never failed to aggrandize himself by the plunder of the poor farmer. Oppression in this respect was then exercised to an injurious extent. Now the farmer can take his produce to a seaport, if he be near one, and dispose of it at the current market price, or if he be too distant for that, he has a better knowledge of its value. The dealers having more competitors, and being more thrown upon their individual skill, display greater activity Some of them purchase stock in the country, and fetch them for sale to the Smithfield market in Dublin; others purchase their stock in that well frequented market, which is held on Thursday, ship them for Liverpool on Friday or Saturday, and dispose of them there either on Monday, or send them to Manchester on Wednesday, and return again to Dublin in time for the market on Thursday. In this manner many of them, clad in humble garb, turn over large capitals every week, some buying to the extent of eighty to one hundred head of cattle and scores of sheep; whilst others must confine their purchases to half a score of pigs; a cargo of live-stock, not unfrequently belonging to perhaps not fewer than a hundred such individuals. Besides for live-stock, there are large and petty dealers in eggs, butter, poultry, fruit, &c., who make weekly voyages to dispose of their purchases in the English markets. We believe the greatest proportion, if not the whole, of this carrying trade is in the hands of Irishmen. And such is the force of national feeling in them, that they will only intrust their own countrymen as agents to dispose of their goods in the English markets.

Besides activity, this intercourse has improved the character of the Irish farmer and dealer in just dealing. The farmer, although sensible of the oppressions of the dealer, and the latter desirous of extracting from him large profits, yet both endeavoured at first, by adulterations and deceptions, to circumvent the English purchaser. The natural consequence of such unjust dealing was the return of the articles on the hands of the disposers. Frequent losses incurred by this just retribution, have taught each of them to prepare his commodities according to the taste of the market which he frequents. They are now both sensible that it is only the fair and honest dealer who obtains the readiest market, and the best price for his commodities.

Moreover, this intercourse has taught both the Irish farmers and dealers a knowledge of the markets of Great Britain. They are now both aware that their butter must be unadulterated and better in quality than grease; that their eggs must be fresh; that their fowls must have something more upon them than bones and feathers; that their cattle, and sheep, and pigs, must be composed of more enticing materials than skins and bones, before they will find purchasers in the English market. The Irish breed of pigs, fifteen or twenty years ago, was as far removed from excellence in points, as the liveliest imagination can conceive. They are now much superior in form, and were they fed on as good food as the English or Scotch pigs, the Irish pork and ham would acquire as high a character in the market as the British. The condition of Irish cattle and their quality as to breeding have much improved of late, for bulls of the most esteemed breeds from Britain, particularly Short-horns and Devons, have been imported for the purpose of judicious crossing with the native breeds. Flocks of Leicester sheep have also been imported from England, and the effect of the deep and rich pastures of Ireland in increasing the weight of their wool and mutton may now be witnessed any week in the markets of Dublin and Liverpool. Formerly the beef trade in Ireland was chiefly confined to the curing of beef for the navy and army, and colonies, and during the existence of this trade, the farmers suffered severe hardships and losses from the exactions of the contractors. Now, in conjunction with the curing trade of both

beef and pork, which is still open to the Irish farmers by competition as before, but on a better footing, the British markets are thrown unrestrictedly open to their live-stock. The increase of live-stock in Ireland in numbers, weight, and quality, since steam-navigation opened the English markets, is already unprecedented in the annals of any other nation; and were the cultivation of turnips universally adopted in that country, and to which there exists no physical impediment, its whole stock might at all seasons be sent in the highest condition to this country; and thus the profits of the grazier and feeder might be enjoyed by the breeder himself. British capital thus finding its way in return cannot fail to stimulate the exertions of the breeder, and reward the industry of the cultivator. So favourable an opportunity as this never before presented itself to the landlords of Ireland, to improve simultaneously the condition of their land and their small tenants, by giving a proper direction to this capital, and prompting their tenants to adopt the best system of husbandry, and participate in the advantages derived by the larger tenants, in the proved excellence and certainty of the English markets.

Scotland has long enjoyed similar advantages. Like Ireland she is enabled by the perennial pastures of her hills and glens, to rear much more live-stock than her scanty population can consume; but unlike Ireland, in being joined to England by land, she has enjoyed that advantage from time immemorial, and since the Union, in perfect safety. Droves of cattle have thus for a long period found their way into England, where they have been fattened on rich pastures, and rendered fit for the metropolitan market. It is probable from the insular situation of the Western Isles, that the fine cattle reared there have long escaped contamination from crossings with the coarser breeds of the mainland, and been held in security from the marauding excursions of the predatory bands which used to molest the farmers in the plains. The surplus stock reared by the small tenants of these isles were clubbed together in droves and purchased by dealers from England, who met them on the road. These droves were placed under the guidance of a confidential person well practised in the sale of cattle, and who on his return home, divided the cash amongst the farmers in proportion to the size and value of their lots, and deducted the necessary

expenses in the same proportion. When all parties became better acquainted, much of the trade was carried on by correspondence, but which at length gave rise, it may be supposed, to disputations regarding the condition, age, and value of their respective lots. This kind of traffic was practised before the institution of trysts. It was a much more satisfactory arrangement, however, for all parties, to appoint a day and place of meeting; and for this purpose the Sheriff Muir to the northward of Stirling was first selected for the purpose. The tryst was afterwards shifted to Stirling, and then to Stenhouse Muir near Falkirk, which to this day forms the site of the largest tryst in Scotland. Since this tryst has been instituted others have been established on all the drove roads towards Falkirk, and on their way thither droves may change hands three or four times. This central point attracted stock from all quarters, from Caithness to the north, Aberdeen to the east, and Argyle to the west. This tryst was the starting point for England. Here lean and fat stock congregated for the same destination, all to be fattened on the rich pastures of southern England. Although many of the heavy cattle from the eastern parts of the country were fat, the journey to England rendered them as fit objects for those pastures as the leanest.

But, until the introduction of turnip husbandry, all fat stock was of course grass fed, and if they were kept on during the ensuing winter, their condition fell off and had again to be made up in the summer of the ensuing year. Meat markets were thus only supplied in summer, and people were then content to eat salt meat all winter. Turnips at length afforded fat meat fed in winter, all of which at first was readily consumed at home, but by the extension of their cultivation a portion of the fat stock was exported to England. The southern counties of Scotland first cultivated the turnip, and of course, first enjoyed the benefits of feeding cattle in winter. The large markets of Morpeth, Edinburgh, and Glasgow, consumed all that were fattened for many years. But, when at length turnips became extensively cultivated in the northern counties, the quantity of fat cattle brought into the market greatly exceeded the demand of the country. They were driven into England, and being obliged to be taken to their destination on foot, their con-

dition, as when they were grass fed in former times, not only was greatly impaired by fatigue, but what flesh was left upon them was deteriorated in quality, and disposed of at a lower price, or the cattle were kept on at additional cost, until their condition was restored. In either case, the driving of fat cattle was attended with loss to the dealer, and were it not that they were generally destined for the London market, where prices are usually above those of the country, such a trade would never have been prosecuted, and the advantage of the turnip culture been confined to the rearing of lean stock for the English, and of fat for the limited home market. To shew more forcibly the deterioration affecting the driving of fat cattle, we have only to consider the actual loss and expense incident to driving. The driving of a fat beast to Barnet or Norwich causes it to lose at least six stones of beef and one stone of tallow; and six stones at 6s. per stone imperial are 36s.: the expenses of driving 400 to 500 miles, are from 30s. to 40s, say 35s., together L.3, 11s.; but in order to restore the condition of the ox, he will require a month's feeding on the finest pastures before there will be a visible improvement in his condition, and which at 5s. per week will enhance the expenses to L.4, 11s.; whereas the loss sustained by steam conveyance is only about two stones.

Now, steam-navigation has greatly altered the nature of the cattle trade in Scotland. All the superfluous fat cattle are shipped for London. The fat cattle and sheep which used to spend weeks on the hot and dusty roads are now transported, in the course of a few hours, to the metropolitan market, no longer subjected to privation of food than what is congenial with the healthy condition of the animals; for food is generally presented on board at pleasure. This trade, first begun at Leith, has extended itself to Dundee, Berwick, Montrose, Aberdeen, Inverness, for the London; and from the Solway Frith for the Liverpool market. It is already an extensive trade; and, were freights but a little more moderate on the east coast, thousands of lean stock might be sent by the same mode of conveyance to the pastures of England. The fat trade is chiefly carried on in winter and spring, and a little in grass-fed stock in summer; but, were lean stock conveyed in the same manner in summer, a large trade in stock might be carried on all the year. The charges made

at present from the midland counties of Scotland are, 40s. a head for cattle of all sizes and conditions, 3s. 6d. for sheep, and 2s. 6d. for lambs; but fat cattle should be charged according to their size, and lean cattle should not be charged in the same proportion as fat.

It would be very desirable to ascertain the quantity of stock thus sent to the English market, and to shew its progressive increase since its commencement; but, as stock pays no custom-duty, no records are kept at the Custom-House of the quantity shipped, and the shipping companies are unwilling to expose the extent of their trade in this respect. The shore-dues offices can furnish the number of kinds of stock exported, but no distinction is there kept of the number of fat from lean, nor can they furnish the weight of meat shipped, as the dues are imposed by the barrel-bulk. This table shews the number of cattle, sheep, horses, and pigs, and barrels-bulk of meat, shipped from Dundee, Aberdeen, Leith, and Inverness, from 31st May 1836 to 31st May 1837, as furnished by the collectors of shore-dues, viz.:—

	Cattle.	Sheep.	Lambs.	Horses.	Pigs.
From *Dundee*—					
Per Smack for London, .	46	80	...	...	...
... Steam-Ships, do. .	1474	2010	3460	42	...
... Do. for Hull, .	280	302	50	22	...
	1800	2392	3510	64	
From *Leith*, for London, .	249	3194	4059	67	...
Do. for Hull, .	3	2	...	16	...
	252	3196	4059	83	
From *Aberdeen*, . .	7443	945	...	50	2162
From *Inverness*, from 29th September 1836 to 31st May 1837—					
Per Steam Vessels, .	41	80	...	...	...
... Sailing do. .	70	...	...	...	...
	111	80			

Meat—

From Dundee, 940 barrels bulk.
... Leith, 8798 do.
... Aberdeen, 1483 do. and 215 carcasses of mutton, and 300 tons pickled pork.
... Inverness, 400 do.

11,621 do. at 2¼ cwt. per barrel bulk, are equal to 29,052¼ cwt.

To shew the advantage to the shipper of stock by steam, even at high freights, compared to driving them on the road, let us take two lots of cattle, each sent to London by the different routes, and ascertain the cost of expenses when arrived at their destination. Supposing 100 cattle of 50 stones, at L.15 each, divided into two lots, those sent by the road will stand thus at the end of their journey :—

50 stones, less 6 stones loss = 44 stones at 7s. 6d. per stone,		£16 10 0
Deduct driving expenses, .	£1 15 0	
... commission, . .	0 4 0	
... hay or grass in London, .	0 2 0	
... driving into market, .	0 1 0	
		2 2 0
		£14 8 0
Shewing a loss per head of		0 12 0
		£15 0 0

Those sent by steam will stand thus :—

50 stones, less 2 stones loss = 48 stones at 7s. 6d. per stone,		£18 0 0
Deduct freight, . . .	£2 0 0	
... commission, . . .	0 4 0	
... hay or grass on board, .	0 2 0	
... dues and wharfage, .	0 6 0	
... hay or grass on shore, .	0 2 0	
... driving to market, . .	0 1 0	
		2 15 0
		£15 5 0
Shewing a profit per head of		0 5 0
		£15 0 0

From this statement, it is clear that, were the freights more moderate, the profit would induce the trade to be prosecuted with vigour. But this statement supposes both lots to be sold at the same price, whereas that sent by steam would fetch at least 6d. per stone more than the other, or L.1, 4s. Were both lots sent to be grazed, that sent by steam would take on to feed in fourteen days after the shipment, whereas that driven by land would take at least a month, thereby shewing 10s. a-head to the advantage of steam. Besides, the natural juices of the steam-carried lot would be retained, whilst those of the driven would never recover their quality. High as the freight of steam is, it is

trifling compared to the deterioration affecting the beef, tallow, and quality, and the loss of time and extra food consumed by cattle driven by land. It should also be borne in mind, that these calculations have been applied to moderate-sized cattle, which are in general good travellers; but, were the effect of travelling on heavy cattle of sixty and seventy stones to be ascertained, the difference would appear to be still greater in favour of steam transport; and there is another circumstance in favour of steam which should not be overlooked by dealers, and that is the rapid return of capital effected by the quick transit of stock by steam. Owing to the high freight, the profit by steam is not great, but the trade thus calculated shews *a* profit, which cannot be depended on in the trade by land; and, were a shipper only to send regularly twenty beasts a-week, he could contrive to make a livelihood on the profit, small as that may be. So far from dealers depending on profits by driving fat cattle to the English markets, they are driven to the necessity of confining their dealings to lean cattle, upon which, when keep is plenty and the markets brisk, they may derive profit; but if not, which is too frequently the case, they are obliged to procure food at exorbitant prices to keep their beasts alive. On the other hand, half-fat cattle will find a market in Smithfield if they have been brought by steam, for they will cut up clean and bright, whereas, of those which have been driven 400 or 500 miles on land, however well, many will be shoulder-shaken, and cut up so damaged, that two or three joints of both the fore and hind quarters will be spoiled. Driven cattle are frequently damaged by slips and pores when over-reached, which they are frequently obliged to be. For instance, Darlington market is held on Monday, from which cattle are frequently sent to Leeds, a distance of sixty miles, in two days, to stand the market there on Wednesday. We have heard it stated by respectable dealers in Darlington and Leeds, that cattle will lose from 28 lb. to 32 lb. in these two days' journey; and that they would rather pay 10s. a-head to have them conveyed by the railway, than 2s. 6d. to have them driven. It by no means follows, however, from this instance in favour of carriage by railway a short distance, that railway conveyance for long distances can ever come into competition with steam-navigation, or even with driving; for the

;e of 3d. per mile for an ox by the railway, which is said to
ıe general charge exacted, and, indeed, estimated by the
which they occupy compared with passengers, they cannot
be charged less, would incur the expense of L.5 for 400
. Railways may be useful to agriculture in the carriage
erishable commodities, such as meat, butter, fish, and the
but not the ordinary products of the farm. The same
rks in regard to the conveyance by steam compared to that
riving, will apply as well to sheep as to cattle. The freight
eep compared with their bulk and stowage is exorbitantly
but still their condition is so superior when carried, that
ealer will travel them the long distance if he can avoid it.
butchers in Liverpool will give 2s. or 3s. a-head more for
that have been borne by steam from Dumfries and Gal-
r than for those travelled by land; and as this is the case, a
tation is thus strongly urged upon the shipper for the em-
nent of steam. But no kind of stock is so deteriorated by
ıg as lambs. They sink very fast on the road after the
d day's journey, and lose not less than 6 lb. out of 32 lb.
eam they will not lose above 1 lb. or 2 lb., so, as a set-off
st high freight, the saving upon them by steam amounts
½ per cent, which, if realised, would be a fair profit. The
of lamb in the Liverpool market being as high as in Lon-
a great stimulus has thereby been given to the rearing of
in the south-western portion of the country, so that sheep of
uality are now sent from Dumfriesshire and Galloway, both
nd half-breds, many of them equal in breeding, weight, and
ty, to any reared in the Borders. No quarter of the king-
has benefited so largely by steam-navigation as Dumfries-
and Galloway, which, no doubt, may greatly be attributed
e encouragement given to shippers by the moderate freights
ed in that quarter; for large fat cattle are only charged 12s.
Port Carlisle, Annan, Waterfoot, Wigton, Kirkcudbright,
eston, and Dumfries, to Liverpool, small and grazing cat-
., fat sheep 1s. 6d., and lean sheep and lambs 1s. a-head,
charges are not more than the expense of driving. It is
obvious from this and other circumstances, such as the
ion of twin decks, that more encouragement is held out by
wners of steam-vessels to shippers of stock on the west

coast than on the east, where the principal accommodation is appropriated to passengers.

So long as we are adverting to the trade by steam on the west coast, we cannot refrain from noticing the change that has already been wrought on the condition of the Western Isles, in having Glasgow market at all times accessible to them by means of steam, and of anticipating a still greater change to their advantage. Instead of depending so much on Falkirk trysts for the sale of their lean stock, the farmers in these islands should endeavour to supply the Glasgow market with fat cattle, not for one of the seasons only, but all the year round, especially as the competition from the east coast in that market has been greatly lessened by the removal of the heavy cattle by steam to London, which used to be sent to Glasgow, as the statement of exports from Dundee and other ports, given above, clearly evinces. The pastures of the Western Isles are excellently adapted for grazing; and were the farmers to endeavour to raise turnips, of which much of their land is quite capable, they might almost have the monopoly of the Glasgow market, and enjoy the profit of the feeder as well as that of the breeder; and nowhere could finer quality of meat be produced. This consummation for these farmers could be accomplished by themselves, by merely stocking their land lighter in summer, and raising turnips for feeding stock in winter. Such a system would also be more profitable for them than the one which is pursued; for, instead of only realising L. 7 or L. 8 for good three-year olds, L. 13 or L. 14 might be obtained; so that the question with them is reduced to this, Whether there would not be less risk, less trouble, and more profit, with two cattle worth L.28, than with three worth only L. 24? The same reasoning applies to sheep. When land is as heavily stocked as at present, 15s. or 16s. may be considered a fair price for a three-year old Blackfaced wether, whereas, if it was more lightly stocked, the same wether might realise 25s.; and if they were fed in winter on turnips, even a higher price might be realised for them, and fat lambs could then be sent in spring off the grass to the Glasgow market. Nor should we overlook the importance of the small dealers in eggs, butter, and poultry, who attend the Glasgow market, to the small tenants in the Western Isles, the minor products of whose farms

now realise fair prices, and are carried away by steady customers. These industrious dealers are the chief support of the small steam-boats which frequent the tiny harbours of the Western Isles; and they go to their task of collection, and return as soon as they have disposed of their commodities in Glasgow. So also has a great impulse been given to the stock trade of the north of Scotland, since the Edinburgh and London markets have been made accessible by steam-navigation. It was only the other year that stock reared in the north were obliged to be kept in easy travelling condition, to be safely driven to Glasgow and Edinburgh. Now the facility of shipment at Inverness, Invergordon, Findhorn, and Burghhead, for London, has not only induced the farmers to fatten them for slaughter, but now to do it with safety to the animals. One great drawback to steam-navigation in this quarter is the want of coals, which must chiefly be brought either from the Frith of Forth or Newcastle; but even this formidable impediment, we are happy to observe, does not prevent the spirited prosecution of the trade in this quarter of the country.

A remarkable feature in the stock trade by steam is its participation by many people who have no knowledge of stock. Like the free tea-trade to China, men of every profession have entered into the trade of importing stock by steam. Merchants, bakers, grocers, are now exporters of stock; and, as they cannot possibly be judges of them any more than of the quality of tea, they are obliged to entrust the purchasing and shipping of them to persons who may be quite ignorant of the London trade. That many shippers of stock are really ignorant of the business which they take in hand is clearly evinced, both from the unsuitable condition of the living animals which they send, and, more particularly, from the condition of the meat which they consign to the care of salesmen in the metropolis. The meat thus sent is likely to be that of animals in a half-fed state, slaughtered in a filthy manner, cut up in ignorance of the wants of the London market, and packed so as would injure the finest quality of meat. It is therefore not surprising, that meat thus handled and shipped should be stained when it arrives at its destination; and when the salesmen, under the circumstances, cannot possibly realise the top prices, blame is imputed to them for not having

sufficiently studied their employers' interest; and thus loss, instead of profit, accrues from mismanagement. Now, were the beasts sent alive in even a half-meated state, they could be sold to be fed, and thus probably realise a profit; but when meat is sent in the manner described, such prices must be accepted as the market of the day affords; and being a perishable commodity, it must be sold at any price. To prove still farther the ignorance of some who have entered into this trade, whole carcasses have been sent salted to London, in order to prevent the spoiling of the meat in warm weather! Such a proceeding had obviously arisen from the supposition, that roasting pieces salted would sell in London. The natural consequence was, that the prime roasting pieces sold for no more money than the coarse boiling; and, of course, loss necessarily ensued in the speculation. Such shippers do not seem to be aware, that in London different cuts of meat fetch very different prices. They do not seem to know, that roasting and steak pieces fetch higher prices than boiling; that, in short, from one penny to twopence per pound is the usual difference of the price of meat from the same carcass. In Scotland this distinction is too little attended to, and hence the origin of the ignorance we have been deprecating. It would be essential to the welfare of every shipper of meat and live-stock to proceed to London, and acquire a knowledge of its trade, before he presumes to supply the wants of the metropolis in butchers' meat. The trouble and expense thus incurred will be far more than compensated by the success which will afterwards attend his business. He will soon discover, that to prepare live stock or meat for the London market requires a nicety of hand and care which he had previously no idea of. Even the best quality of meat, superiorly slaughtered and packed, he will soon discover, will run the risk of being stained and bruised on the shortest voyage in the most favourable weather. Nay, he will soon observe, that the retail butcher, who has a regard for the taste of his customers, will not send even a prime leg of mutton for boiling that had been slaughtered out of, and carried into London, in case it should have been bruised. He will reserve it for roasting, a species of cookery which conceals much of the blemishes in meat. Such is the usual delicacy with which meat is treated in London. Salesmen, it thus appears,

have a difficult part to act when doing business for persons who are ignorant of the London trade. It must be confessed, the temptation is great by the facility into which this trade may be entered. The driving trade, to be profitable at all, must be carried on in a great scale, small lots never repaying the cost of travelling. But any man who can command as much cash as will purchase an ox, half a score of sheep, or a score of pigs, can become a shipper of stock or meat, and he himself may take no trouble in the matter, but entrust the purchasing and shipping to the shipper, and the disposal of it at market to the salesman, who remits his account of sales and cash as soon as the meat is disposed of, being generally from five to seven days after shipment. He thus receives his money in a few days for a new speculation.

But there is no difficulty in acquiring a knowledge of the London stock-trade. A single inspection of the different markets in which Scotch meat and stock are exposed, will give more insight of the trade than the pursuit of it for years in this country will ever impart. Thus, in going into Newgate market of a morning, there will be seen baskets, hampers, boxes, and packages, of all sizes and descriptions, containing carcasses of mutton, pork, and beef. Some of the carcasses may be observed to be wrapped in clean cloth and straw, and taken out of the package clean, bright, and fresh; others huddled together without any covering, in a state almost disgusting to contemplate. The former lots are readily disposed of to the west-end butchers at top prices; the latter will hang on hand for hours; and, if the weather is such as to taint meat soon, that which is worst handled will taint the soonest, and will have to be disposed of during the first day; and after cutting and dividing pieces to please customers, who seem as if they were conferring a favour in purchasing such meat, the whole is sold at low prices. Other lots may be wrapped in dirty mats to save expense, and disposed of at only middling prices, although the meat may have originally been pretty good. It is not easy to conceive the difficulty which a salesman has to encounter in disposing of perhaps 300 of such mismanaged packages in one day; and any one who has witnessed those difficulties must acknowledge, that the salesman does every thing in his power for the interest of his employers. But

great is the difference in the satisfaction which he feels, between having a good and a bad article to dispose of; and yet it is too often unreasonably expected, that mangled meat shall realise as high prices as that which has been selected with judgment, and managed with care. It must be obvious, however, to the most inconsiderate mind, that the trouble of disposing of meat in an injured condition must be increased to the salesman in a tenfold degree. This consideration should induce the salesman to charge for the time consumed in disposing of meat, as well as the quantity disposed of, in order to encourage the judicious shipper to persevere in that wise career, which is conducive to both their interests. We cannot therefore too earnestly and impressively enforce on all shippers of stock and meat, whether from this country or from Ireland, as well for their own profits as the character of their respective countries, only to export for the London market well-fed stock of fine quality, and the choicest pieces of beef, or carcasses of mutton and pork, carefully driven before being slaughtered, cleanly slaughtered, and packed in cloths, or clean drawn wheat-straw, in baskets made for the purpose. Such conduct will insure a recompense per stone for live stock, or per pound for meat, for the additional care; and besides, as all the charges of freight, wharfage, and commission, affect alike in amount the valuable and valueless stock, it appears little short of insanity to tranship inferior quality of stock and meat to a market in which the greatest difference is made in price, according to the quality of the articles sent to it.

As the conducting of this trade in a proper manner is so intimately connected with the prosperity of those who embark in it, and the character of the country as a nursery of good stock, we may be forgiven if we venture to give a few instructions derived from experience, in the selection of live-stock and meat, and the preparation of both for exportation by steam to the London market.

1. *Selection of Cattle and Beef.*—In the selection of cattle to be sent alive, they should invariably possess fine symmetry and small bone, carrying the greatest weight of beef on the most valuable points, such as rumps, loins, and crops; the back well covered, the buttocks and flanks well filled up, and the whole carcass exhibiting a fulness of flesh, excepting the necks

and coarser parts. They should handle hard and firm, when they will stand the voyage, and handle and look well in the market. Firm handlers, whether heifers or oxen, always cut well up. A good coat of hair too, is of great use in a sea voyage on deck, and also of enabling cattle to stand the vicissitudes of weather in the markets, and it enables them to be turned out in safety, in case they should not be disposed of in the first market day. Thin coated cattle always look tender, and are, in fact, so under any circumstances. Cattle only possessing these requisite properties should be sent to Smithfield market, and any others will assuredly incur loss to the shipper. An ox or heifer of these properties weighing eighty stones per Smithfield stone of eight lb., will actually realize more money than a coarse ox or heifer weighing 100 stones. Heavy cattle, however, do not take readily in Smithfield, except for a month about Christmas, unless they are remarkably handsome; nor do very light cattle under forty stones, for two or three months in summer, unless they are really neatly shaped, and thick on the backs and best points. The most saleable weights are from fifty stones to fifty-five stones. Of the Scottish breeds, the Galloway and West Highlanders fetch generally the top price; fine Angus and Aberdeenshires, of fine points and thick backs, take well; and handsome well bred Short-horns also take readily, but do not realize so much money as Galloways or West Highlanders. Fine crosses are also very saleable.

The meat intended to be sent to the carcass market in London, should be taken from such cattle as we have described. It is not large quantities of lean and fat that are wanted there, but both well mixed. Ox and heifer beef of equal quality, command the same prices. Rumps, loins, crops, and other fine parts fitted for roasting and steaks, are more in demand than the boiling pieces, and realise comparatively higher prices, and therefore they alone should be sent. Coarse beef always fetches low prices in London, and therefore should be purchased, to use a sporting phrase, at a low figure in the country to return any profit, for the best buyers look more to quality than quantity; and as this quality of beef is rather cheaper in London than in Scotland, shippers should be cautious in sending any such thither.

2. *Selection of Sheep and Mutton.*—Ripe, compact sheep, of light weights, carrying a large proportion of lean on the back, loins, and shoulder, with a full round leg and handsome carcass, are admirably suited for Smithfield. Such from 14 lb. to 20 lb. per quarter, will take readily, but they are most valuable from 16 lb. to 18 lb. The nearer the form and quality approach those of South Downs, the more likely are they to command the top prices, for the Downs have long been unrivalled favourites in Smithfield. True bred Cheviots and the Blackfaced Linton breed approach nearly to the qualities of the South Downs, and command as high a price. Half breds from Leicester rams and Cheviot and Blackfaced ewes, which resemble the true breeds in form and quality, form saleable sheep in London. The old Blackfaced breed are too thin in the leg and back, and are in London termed "*goaty.*" There are by far too many of this kind sent from Scotland, and they are generally, besides, only half *meated*, or half fat, and of course only fetch middling prices. They, however, generally please the consumer for flavour. Pure bred Leicesters are too fat, unless they are sent young, and do not exceed 20 lb. per quarter; when above that weight they fetch inferior prices. A fine South Downs or Scotch sheep, of 18 lb. per quarter, will fetch 7d. per lb. by the carcass, whereas a heavy Leicester, Gloucester, Lincoln, or Kent, of 24 lb. a quarter and upwards, will realize no more than 6d.

The carcasses of mutton, to be sent to London, should, of course, be those of sheep, such as are here recommended to be sent alive. Large quantities of fat are not so desirable as a proportionable mixture of fat with the lean. In using the loins and other parts of very fat mutton for chops, much of it has to be pared away, and sold for the price of raw fat, perhaps fourpence a pound; whereas well mixed chops may be sold for sevenpence or eightpence a-pound. This shews the nature of the mistake committed in sending fat heavy mutton to London. The great point is to select ripe mutton and sheep, for the latter will stand the voyage better than half fat, and will not lose half the quantity of flesh in three days as the latter. No overgrown animals having masses of fat on one place and not on another, would therefore command the top price, but those having plump carcasses, well mixed with fat and lean, firmly and equally laid

on, with fine symmetry and valuable points, will always command the top price, both at Smithfield and the carcass markets.

3. *Selection of Lambs.*—Lambs are a favourite stock to send to London, and they are always sent alive. Leicester lambs are admirably adapted for the London market. They are handsome, compact, thick on all the points, and although they might become too fat when grown to sheep, they cannot be too fat as lambs. Their flesh is white, a property much admired in London, and every joint of them looks well on the table. The lambs of the cross between the Leicester and the Cheviot and Blackfaced ewes are next best for fat and lean, and cut well into joints, although they have not the handsome figures of the pure Leicester. True Cheviot and Blackfaced lambs, unless very fat, do not take so well in Smithfield, not being so compact, taking longer time to come to maturity, not cutting up so thick, and presenting small joints on the table; but they make very delicate and high flavoured chops. No lambs should be sent to Smithfield until they are at least three months old, and have obtained the weight of 9 lb. or 10 lb. a quarter, and if they are not fat enough, and have not attained that weight at that age, they should be kept on. Shippers may calculate on a loss of 1 lb. a quarter on the voyage; unless, therefore, lambs are from 9 lb. to 10 lb. a quarter, they would be too small after that loss, and they then become unsaleable except at low prices. Ewe lambs are preferred, being more delicate than wether, which are next in value, for ram lambs are very unsaleable. All wether lambs, therefore, intended for Smithfield, should be castrated when a few days old, and their tails cut short, leaving not more than three inches. The docking gives them a very compact form, and it causes the flesh to grow up towards the back, long tails giving a contrary tendency.

4. *Selection of Pigs and Pork.*—Much caution is requisite on the part of the shipper of pigs for London. A very mistaken notion prevails in Scotland among many shippers, and the notion has been contracted in ignorance of the nature of the London market, that pigs must be fat to suit the English taste. The fact is quite the reverse, for the larger the pig is fattened the less money per pound it fetches. Pigs are worth the most money when their weight ranges from 35 lb. to 40 lb., and from

this weight up to 60 lb. or 70 lb., they are termed *dairy fed porkers.* If at the former weight, they are of good symmetry, fine quality, delicate and white in the flesh, and not more than 1 inch or 1¼ inch thick of fat on the back, they will fetch the top price of the day. Pigs of the average weight of 60 lb. will give about 7d. per lb.; from 70 lb. to 100 lb., averaging 85 lb. and 2 inches thick of fat, 6d. per lb.; from 100 lb. to 150 lb., averaging 130 lb., and about 2¼ inches of fat, 5d. to 5½d. per lb.; from 150 lb. to 200 lb., averaging about 170 lb., and about 3 inches of fat, 4d. to 4½d. per lb.; and all above the last weight and thickness of fat, only about 3½d. per lb. Besides the large sized, a very small fat pig is not relished in London. Indeed, we need not be surprised at this preference, when we consider that only the small lean and fat porkers are used for roasting, chops, and pickled pork, and the large fat pigs, are chopped down for sausages. No pigs, therefore, should be sent to London exceeding 100 lb. exclusive of head and feet, but which are only moderately fat and of fine quality; all other qualities should be cured as flitch-bacon and hams. Pigs, if possible, should be sent alive to London. Occasionally, they arrive in pretty good order in carcass, but in carcass in thick weather, the flesh becomes very soft, and the skin dry, and in dry weather the skin becomes quite hard and brown coloured. Of equal qualities, the live pig will draw from a halfpenny to a penny a pound more than in carcass. Feeders of pigs should be careful on what they feed their pigs, especially fish. The retail butchers are such nice judges of pork, that on buying a carcass at Newgate or Leadenhall market and cutting a slice, they can detect the least peculiarity in taste, which, if they do, they will return it again and cause the carcass to be resold for what it will bring, rather than send any such pork to their customers.

On the proper method of transmitting live stock and meat to London in steam-vessels, much remains to be told, and that much will be best told in systematic order.

1. *Driving Live Stock.*—Although droving is a subject which more properly belongs to dealers who purchase large lots of stock to dispose of at considerable distances from the place of their purchase, than to shippers of stock by steam, yet as the

latter may have to bring their stock a considerable distance to the shipping port, a few remarks on the subject may not be here irrelevant. When cattle are to be drove to the shipping port, preparation should be made for some days previous to their undertaking the journey from the place at which they have been fed. If they have been feeding on turnips or grass, less green food, and some dry food as hay, should be given them for some days, in order to lighten their bowels for ease on the journey. For two days at least before they start, they should be let out of the court, and especially out of the close-house or byre, to move and dance about for a short time in a guarded place or large court; for cattle, when let loose from confinement, are at first very giddy, and will even run against any object and throw themselves down. This giddiness affects cattle that have been confined all winter in byres, much more than in hemmels. But they have a great disposition to romp and skip about even after let out of one field into another; the sense of liberty overcoming the sense of propriety, which they violate on those occasions with ridiculous earnestness. Nay, the serious antics of some cannot fail to excite risibility in the spectator even to a greater degree, than the tricks of a clown. But these humorous ebullitions of cattle are sometimes attended with more serious consequences than laughter; they may cause a hoof to be thrown off, a horn to be broken off, a tendon to be sprained, ribs to be bruised, a shoulder to be shaken to jelly, the body to be inordinately heated, and the tallow within to be melted; and any one of these accidents will prevent the animal being removed from the premises, perhaps for some time, for sprains of the tendons and shocks of the shoulders are frequently very tedious in healing. It will thus be seen how cautiously cattle ought to be removed from the quarters which they have occupied for some months. Besides these precautions at home before they start on their journey, they should be moved very slowly along the road for the two first days, not exceeding seven or eight miles each day. At night, in winter, they should be put into open courts or sheds, and in summer they can rest by the side of a green road or in a grass field. These remarks apply either to lean or fat stock, but especially to the latter, for their weight and high condition render them more liable to injure themselves

when in high spirits. After the first two days on the road they attempt no more vagaries, and may be travelled from twelve to thirteen miles a-day with impunity, provided both the road and weather are favourable for travelling, and lean cattle fifteen or sixteen miles per day. There is great difference between drovers in travelling cattle; some will tend them for weeks on long journeys, and accomplish their task with comparative ease to their charge; whilst others, though they may not actually cause lameness, will yet injure their condition so much as to render it irrecoverable for some time. There is also great difference in the mode that farmers adopt in driving their cattle to market. Some will take them into it quite cool and placid, whilst others will exhibit them breathing high with distended nostrils, reeking with steam from their bodies, and quite loose in their bowels with a surcharged quantity of green food. Cattle may thus be easily injured to the extent of a pound a-head or more. On this account a good drover deserves to be well remunerated for his irksome task. It would be much better policy for the farmer to give his cattle corn and hay for a few days previous to taking them to market, than run the risk of injury by improper driving. Good judges are very chary of purchasing cattle in an overdriven state, for not knowing the extent of the injury which they have received, it may be that a long time will elapse ere they completely recover. In case of such risks, shippers of cattle for London should be cautious in purchasing cattle that have been driven from a distance to a market; they should rather purchase them on the farms they have been fed, and drive them away when required by their own drovers. One source of annoyance to drovers on the roads is, the many gates into fields which are too frequently left open, greatly to the injury of the stock driven along the road as well as to the growing crops. Ploughmen on leaving work in the fields, almost always neglect to close the gate behind them. Dogs should never be used in droving cattle; they vex them more than assist the drover. When cattle are put on board the steam-vessel, they should be provided with hay, and by the time they have arrived in Smithfield they have taken with the hay, and handle firm in the market. Butchers in Smithfield attend to this point of handling in judging of cattle; for they cannot be deceived by their being

blown out with green food. Too many cattle are huddled together in one pen on board of steam-boats: they should never exceed two together in one pen, and if they have as much room as that one may stand whilst the other rests, they would not thus occupy an inordinate space of the deck or hold. Bruises inflicted on fat cattle cause the bruised portions of the flesh to assume that species of inflammation commonly called *blood-burning*. Cattle that are intended to be slaughtered at the shipping-port, should be driven with as much care on the road, however short the distance they have to travel, as those which are sent alive to London. They should rest two days, be fed on hay and water, and starve for twelve hours before being slaughtered, when their entrails will be in a proper state of emptiness.

As we are discussing the subject of droving, we may say a few words on the mode adopted by the large dealers. When a dealer purchases a lot of two hundred or three hundred head of cattle, and intends to drive them four hundred or five hundred miles, he fixes a day for lifting them with the respective farmers from whom he had purchased them. He has what is called a *topsman*, that is a person who hires the requisite number of drovers, and whose special duty is to provide keep for the cattle and pay all charges on the road, and take the general superintendance of the drove, and act for the best towards them according to circumstances. The cattle being in different lots on different farms, he first lifts the farthest off lot from the great road upon which they are all to travel to their destination; and in lifting them he uses all those precautions which have already been described on first taking them out of their places of confinement, and first two days on the road. There are no dealers so attentive as those who purchase and send cattle from Galloway to Norfolk and other counties in England to be grazed. Experience has taught them to conduct their operations quite systematically; and if it were not for system, they could not possibly send their large droves to their ultimate destination with the success they always display.

On lifting sheep for travelling on the road, the same precautions are required as those for cattle, but only they being at all times at liberty in the fields, will run no risk of injuring themselves by violent exercise. Dogs, however, may always be used

in driving sheep, for it is not possible, from their number and quickness, for one man to conduct a flock along a road, with the chance of meeting many obstructions, without such assistance; but they must never be permitted to irritate the sheep by too much barking and work, or injure them by biting. During the first two days they should be driven with care, and with a slow pace. They should not be put on board too full of meat, or heated by driving; and too many should not be put into one pen, or the pens placed too near the heated flue of the ship, for of all domesticated animals sheep suffer most from the effects of heat. If sheep are intended to be slaughtered at the shipping port, in order to export their carcasses to London, they should rest two days after the journey before they are slaughtered, and stand twenty-four hours of that time without food.

Lambs to be exported, when bred near the shipping port, should be driven on the road and put on board with their mothers, which, after having suckled them as near to the time of sailing as convenient, should be taken away from them cautiously and quietly, or they may be taken from them at the ship side, for lambs drive very ill by themselves on the road, and having thus been left full of milk on board, they will be able to stand the voyage with comparative ease, for no animal suffers from the deprivation of food so acutely, or loses flesh so rapidly, as lambs. When they are bred at a distance from the shipping port, they should be conveyed in carts to the ship; for they never recover their full appearance after being driven fifty or sixty miles on a road. Butchers soon detect their jaded appearance in Smithfield, and offer inferior prices accordingly: they will have probably lost 7 lb. or 8 lb., and when their flesh is so much shrunk, it cannot present a good joint, and it must have lost much of its substance.

No very large droves of pigs are sent from Scotland, for few of the owners of steam-vessels will permit live pigs to be shipped. They are considered of themselves unruly animals, and offensive to passengers; so only the carcasses of pigs are sent to London, which have been slaughtered at the shipping port, or conveyed from the country. In driving pigs, the same precautions as to food is as requisite as for other stock. In England, we have seen large droves of pigs led, not driven, along the

road, by the drover going in advance, and occasionally dropping a bean upon the road out of a bag slung about him; and in their effort to get foremost to pick up the bean, they thus follow the drover. This practice forcibly illustrates that proverb, which says, "It is better to flatter fools than to fight with them." Paddy is not a bad hand at pig-driving. It is very amusing to witness the manner in which pigs are sometimes put on board ship. A plank or gangway is placed to the ship, and the pig is purposely held back, on finding which, he vociferously struggles to gain the deck; piggy's principle of action being by the rule of contraries.

2. *Slaughtering Live-Stock.*—After stock has been carefully driven to the shipping port where it is to be slaughtered, it should be slaughtered in clean slaughter-houses, by expert slaughter-men; for of all things which excite disgust in salesmen of meat in London, nothing excites it so acutely as the reception of meat in a dirty state. We are sorry to affirm that very much of the meat sent from parts of Scotland to be disposed of at Newgate or Leadenhall carcass markets has been handled in a very filthy manner; and hence the opprobrious term of the "dirty Scotch" is not uncommonly heard in those markets. Our butchers should endeavour to render the opprobrium inapplicable to *themselves*. At the same time meat is very cleanly slaughtered in some parts of Scotland, particularly in Leith, Edinburgh, Dalkeith, and Musselburgh, which we are happy to particularize for the sake of the metropolis and its vicinity. Almost every town has its own method of slaughtering animals; but, although this is the case, all the possible variety of ways may be performed in a cleanly and professional-like manner. The London method, however, differs from every method in this country, and when it is known that the London butchers, and the people as consumers, are so partial to their own method, it would be desirable to adopt it in this country, to please them who are our best customers, even although that method were inferior to our own. But we confess that of all the ways which we have had the fortune to witness, and we have seen and studied not a few both here and abroad, we give a decided preference to the London, and have no doubt we are not singular in our preference. We pre-

sume it will not be denied that the beauty and cleanliness of of meat as exhibited in London, excites the admiration of every spectator, especially strangers, and that is certainly more than can be said generally of any town in Scotland. We know that our countrymen are very sensitive on this point, but we hesitate not to inscribe our own candid opinion at the risk of offending a very useful and indeed indispensable and respectable class of men. But we cannot possibly give a wrong advice in urging the adoption of the cleanly and even peculiar usages of a market which consumes all our extra supplies of butcher-meat.

One great difference between the universal Scottish and particular London method of slaughtering oxen, consists in chopping or cutting down the chine or back-bone. In London the bones of the chine are equally divided betwixt both sides, whereas in Scotland one side of the carcass of an ox has a great deal more bone than the other: hence here consumers are unequally served with bone in the side of the ox they may happen to be served from. The bony side is called the *lying* side in this country, and these bones are the *spinous processes* of the veterinarians. Another difference is, that in London these bones in the fore quarter are broken when warm in the middle, as far as the ribs extend, and chopped back with the flat side of the chopper, which thickens the fore and middle ribs considerably when cut up. The London butcher also cuts the joint above the hind knee, and by making some incisions with a sharp pointed knife, cuts the tendons, which contract or drop the flesh of the hind quarter on the flanks and loins, a contrivance which makes the whole hind quarter cut up thicker than the Scotch mode. Another distinction is, that the London butchers, in opening up the hind quarter, cuts the itch bone, the *pelvis*, through the centre, which makes those pieces in even a middling animal look well. Scotch butchers are indifferent as to the cutting up of this part. Some of the north country butchers have a practice of cutting or scoring the fat about the itch-bone, or *closing* of the hind quarter, which has the effect of making that part of a heifer or ox look like that of an old cow. There is too much of this system of scoring practised in Scotland; and when sent to London, where little or nothing of it is to be seen on a carcass of beef, it has a disagreeable appearance.

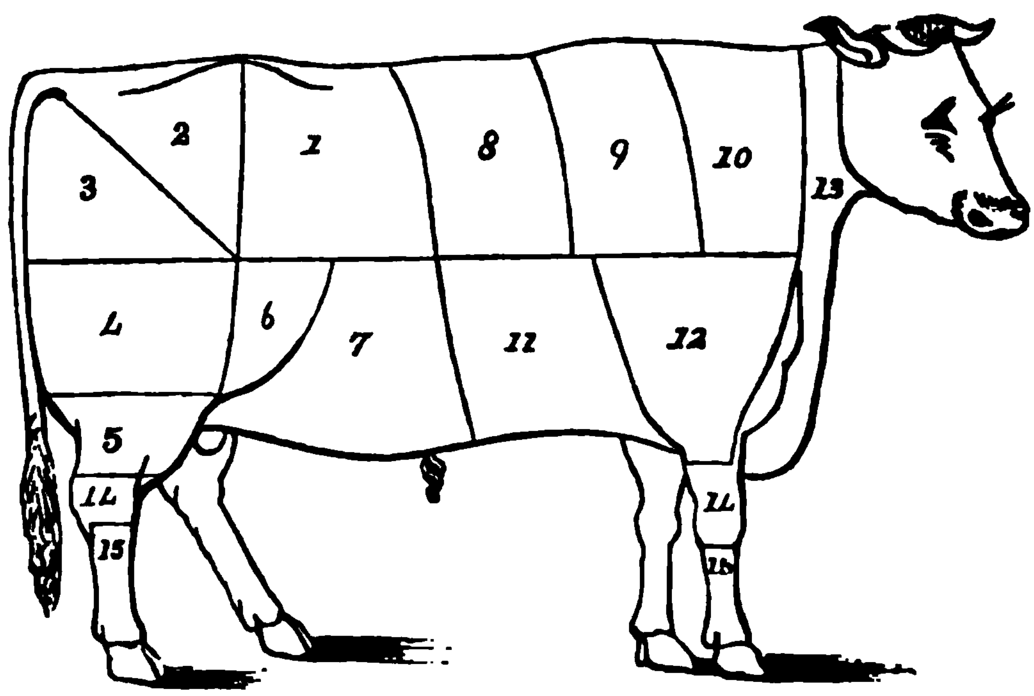
There is very little difference in the dressing of a sheep and pig, neither of which can be too plain done, provided if done clean. The skins of sheep are not taken off on stools in London as in Scotland, but after the body has been hung up by the legs; but it is immaterial how it is taken off, if it be well done. The bone of the fore-leg is left on and skewered up in order to thicken the shoulder. Small flourishing is put on the outside of the carcass of mutton, in place of the plain scoring put on them in Scotland. But when carcasses are sent to London, it is better not to break the fell at all. Calves and lambs are differently dressed in London from this country, but as it is not likely that either will ever be sent to London in carcass, it is unnecessary here to particularise the methods.

Cutting up of Meat.—The modes of cutting up meat is more diversified even than the slaughtering, almost every town having its own. But as London is the great emporium of the export meat trade of Scotland, the method of cutting up meat in the metropolis should constitute the particular study of the shippers of meat. To acquire this necessary information, the shippers should have a few of the most expert butchers in London to slaughter and cut up the carcasses of the various sorts of animals. They should never consider themselves above acquiring such information, when their own interest will be benefitted by its adoption.

Whether the London method of cutting up meat is really the best of any, and we think it is, it must be admitted that the London butchers must have the most extensive and varied experience; and any one has only to witness the operation performed by expert London butchers, to be satisfied that they display great science of their profession, and execute their work with the utmost precision. Indeed, the precision with which they divide the different qualities of meat from the same carcass, shows their thorough knowledge of the qualities of meat; and the variety of prices which different parts of the same carcass fetch, shows with what accuracy they can gratify the tastes of the various grades of their customers. In practising this precision, they not only make the best use of the carcass, but realise the highest value for it, and at the same time gratify the tastes of the greatest number of customers. In the carcass of

any animal, of an ox for instance, there are different qualities of meat, and these qualities are situated in different parts of the carcass. All the best parts are, in London, used for roasting and steaks, and the inferior for boiling, either in pieces or making stock for soups, or minced meat, in the various forms of sausages, pies, &c. The carcass of an ox is cut up into the following pieces, as may be seen on referring to the numbers on the annexed cut, fig. 1.

Fig. 1.



1. *Hind-Quarter.*

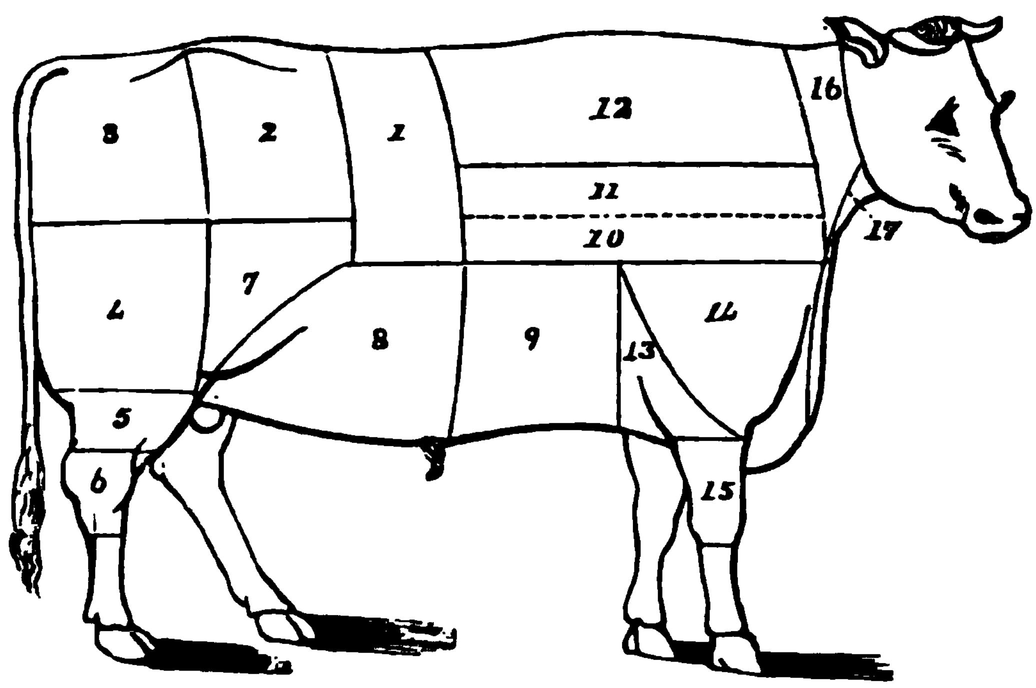
1. The loin.
2. ... rump.
3. ... itch-bone.
4. ... buttock.
5. ... hock.
6. ... thick flank.
7. ... thin flank.

2. *Fore-Quarter.*

8. The fore rib.
9. ... middle rib.
10. ... chuck-rib.
11. ... brisket.
12. ... leg of mutton piece.
13. ... clod and sticking, and neck.
14. ... shin.
15. ... leg.

The relative value of these different cuts of an ox may be stated at their current value, viz. when the rumps, loins, and fore-ribs of a fine ox fetch 8d. a pound, the thick flank, buttock, and middle rib, will fetch 6d.; the itch bone, thin flank, chuck rib, brisket, and leg of mutton piece, 5d.; the clod and sticking, and neck, 3d.; and the legs and shins 2d. a pound. Such is the difference in value of the different cuts of an ox in the meat markets in London! As an object of comparison, we shall also give a figure of an ox cut up in the Edinburgh method, as in fig. 2, and the great difference between both methods may be seen at a glance.

Fig. 2.



1. *Hind-Quarter.*		2. *Fore-Quarter.*	
1. The sirloin or back sye.		9. The nineholes.	
2. ... hook-bone.		10. ... runner,	large and small.
3. ... buttock,	rump.	11. ... runner,	large and small.
4. ... large round,	rump.	12. ... spare rib, or fore sye.	
5. ... small round.		13. ... brisket.	
6. ... hough.		14. ... shoulder lyer.	
7. ... thick flank.		15. ... nap or shin.	
8. ... thin flank.		16. ... neck.	
		17. ... sticking piece.	

Now, in Scotland, in Edinburgh, Glasgow, and a few other of the large towns, the roasting and steak pieces may no doubt be sold at 6d. and 7d. a pound, when the boiling pieces are only worth 5d. and 5½d. a pound; but in most towns, and in the country, the roasting, steak, and boiling pieces, all realise the same price, and even legs and shins of beef fetch 3d. a pound, when the prices of the better parts are as stated above. It is therefore obvious, that of the two methods of cutting up beef, the London affords much more of roasting and steak, that is, the more valuable pieces out of the same carcass; and, of course, more money would thereby be realised from it. But from what we have stated, it is not to be inferred that, were a carcass of beef to be cut up in the London method in Edinburgh, it would therefore realise more money than it does by the Edinburgh method, for we apprehend the London prices will never be realised in Edinburgh, whatever method of cutting up may be adopted. Rump steaks in London are generally sold at 1s. a pound, a price which could never be realised for them in Edinburgh. It may, therefore, be advisable for each

place to retain its own method of cutting up meat. Indeed, the London method has been tried in Edinburgh and other places, and failed to please the consumers. But the case is quite altered when Scotch meat is sent to London. It is then sent for the English palate, and it ought in reason to be so sent as to suit the purpose for which it is sent. It ought to be slaughtered, quartered, and cut up according to the London method, and which can easily be acquired by any expert butcher.

Since then, different cuts of the same carcass of beef, realize different prices in London, and since those of the finest realize much the larger prices, it is truly absurd in Scotch shippers to send coarse pieces to the London market. The same expenses of freight, commission, wharfage, &c. are chargeable against the inferior as the superior cuts, and since those inferior pieces realize in Scotland about as good a price as the best, it is passing strange that shippers will persist in sending inferior meat to London. It is undoubtedly *their* interest only to send the best, and such an arrangement is not against the consumer in Scotland; for, since the inferior pieces suit the tastes and incomes of the working classes, they would consume the inferior pieces of those carcasses, the best of which had been sent to London, whilst the upper class could still be supplied with the best pieces of those cattle which are slaughtered for home consumption; for it is not to be supposed that a portion of every ox slaughtered in Scotland would be sent to London. By such an arrangement the tastes of all classes of consumers would be consulted, whilst the interest of the shipper would be materially promoted. Supposing, for instance, to take a practical illustration, the side of the carcass of an ox were so cut as to remove the thin flank and leg from the hind quarter, and leave the fore and middle ribs of the fore quarter attached to it. All these pieces are saleable in London, and on the average might realize 6d. a-pound, from which would fall to be deducted a halfpenny a-pound for expenses, which would leave 5½d. a-pound; and suppose the remainder is sold at home at 4½d. a-pound, there would thus be realized for the whole ox, on the average, fully 5d. a-pound; whereas, had the whole carcass been sent to London, it would not have fetched more than 5d. a-pound, from which has to be deducted a halfpenny a-pound for expenses, leaving only 4½d.

for the whole carcass, making a difference of 10 per cent. in favour of the London method for the shippers. Besides, it is deserving of consideration, that were the inferior pieces kept at home, the working people of this country would have it then in their power to purchase pieces of beef quite wholesome for them, being portions of well fed animals, but which are more suitable to their circumstances, and more in accordance with their usual mode of living—chiefly on broth and meat, and vegetables; whereas, when the whole carcass, or live cattle, are sent away, only large quantities of offal, and large numbers of inferior beasts, are left to be consumed by the working people.

We have dwelt the more largely on the management requisite in sending beef to the London market, because much of what we have said will apply equally to sending mutton, veal, or lamb to the same market. The best pieces only should be sent to London, and the remainder kept for the home market; and were this recommendation attended to, the expenses of exportation would be diminished on what was sent, for the best pieces would pack well together in comparatively small space, whereas whole carcasses of mutton, by the roundness of the rib, occupy much unnecessary room, for which freight must be paid.

Mutton is also cut up differently in London and Scotland, as may be seen on referring to the two following figures, of

Fig. 3.

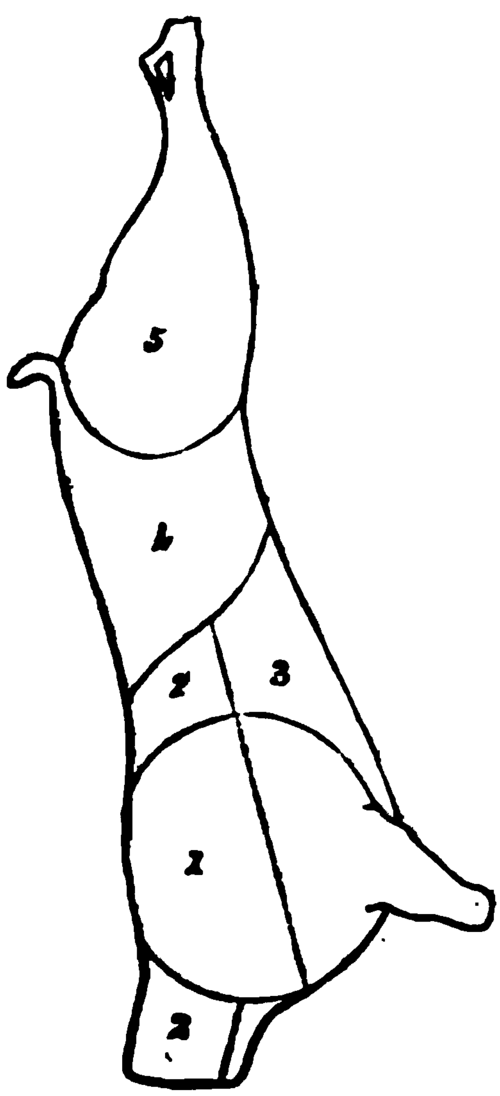
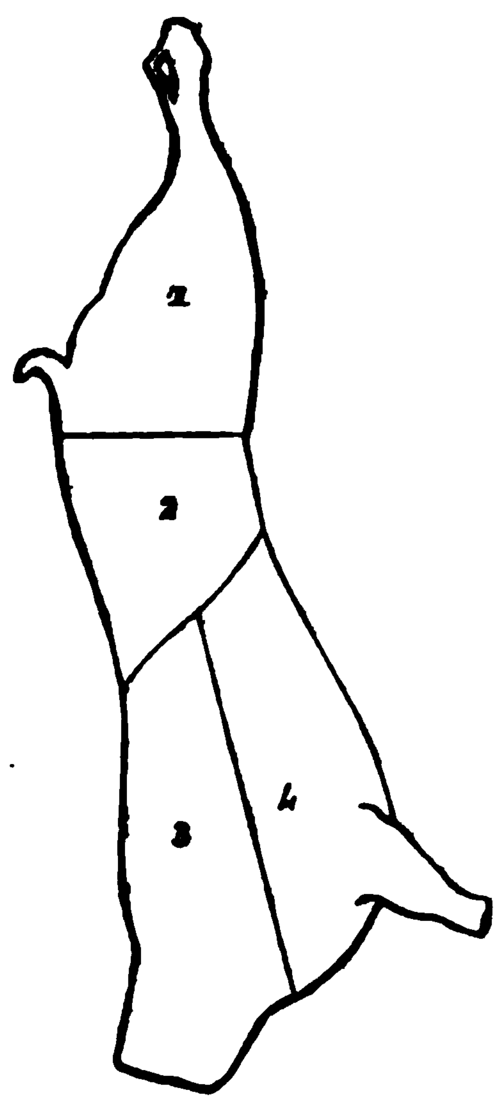


Fig. 4.



which the first figure, fig. 3, represents the London method. In the fore quarter No. 1 is the shoulder; 2 and 2 the neck, after the shoulder has been taken off; and 3 the breast; and in the hind quarter 4 is the loin, which, when cut double, that is, partly from both sides of the carcass, is called a chine or saddle; and 5 is the leg. A leg of mutton in London is cut short; a haunch is cut long, taking in the hook-bone, similar to a haunch of venison. The flap of the loin is left attached to that part of the fore-quarter called the breast. The Scotch mode of cutting up mutton is represented by fig. 4, in which, in the hind-quarter, No. 1 is the jigot, and 2 the loin; and in the fore, 3 the back ribs, and 4 the breast and shoulders. The jigot is cut about half way between the leg and haunch of the London method; and the fore-quarter is cut right through the shoulders in two pieces called back-ribs and breast. Shoulders of mutton are never cut off in Scotland before being cooked, except by keepers of eating-houses, but the London plan of cutting mutton is decidedly the best, the shoulder forming an excellent roast, and the best end of the neck-piece being admirably suited for chops. The different joints of mutton almost vary as much in price in London as pieces of beef. The leg is sometimes sold as high as 10d. a pound, whilst the breast of the same sheep will only fetch 4d. or 5d; and if in the wholesale market the whole carcass is sold at 6d. a pound, the hind-quarter will be worth 7d., and the fore only 5d. From these facts it is obvious, that it is the interest of the shipper only to send hind-quarters of mutton to London, for which 7d. a pound may be easily obtained, and a ready market for them in the west-end butchers, who seldom deal in fore-quarters. The fore-quarters could be sold at home, hence thus realizing as much for them as they could fetch in London, besides saving on them the freight, commission, and wharfage. They form excellent joints for tradesmen's families, and are in fact generally preferred by them to the hind-quarters, which are considered dry eating, and certainly do not make so good broth. Besides the saving of room in packing the hind-quarters, they would run no risk of being stained when sent by themselves, as the staining generally arises from blood oozing out of the veins in the fore-quarters.

Lamb is cut up in London in much the same manner as mut-

ton, excepting that the neck and breast, when the shoulder is taken off, is roasted whole, and the piece is called *ribs of lamb*. In Scotland lamb is cut up exactly as mutton.

Veal is cut up in London in a different way from any other meat. The knife is drawn between the buttock and itch-bone and through the pope's-eye, taking a sloping direction through the thin flank, and a cut is made parallel to it through the leg in a sloping direction through the coarse end of the buttock, leaving a flap. The piece thus cut out is called a *fillet* of veal. It is like a round of beef with a part of the thin flank left to be skewered around it. The round-bone is taken out and stuffing put into its place. When the itch-bone and hook-bone are cut from the loin, the piece is called a *chump* of veal. The hind-quarter of veal thus consists of fillet, chump, loin, and leg. The fore-quarter is cut in the same manner as mutton, having shoulder, breast, and neck. In Scotland veal is cut very much like mutton.

Pork in London is cut rather differently from this country. It is the same as the Scotch method of cutting up mutton, so figure 4 will illustrate the mode, in which, in the hind-quarter, No. 1 is the leg; and 2 the loin; in the fore, 3 back-rib, chine or hand; and 4 breast and shoulders, spring or belly. The spring is used for pickling, and the hand for roasting, pork chops, or sausages. In Scotland the hind-quarter consists of leg and loin, and the fore of back-ribs and breast. For pickling or roasting, pork is cut in the hind-quarter like that of English mutton, and in the fore like that of Scotch. In both countries the ham is cut out alike.

4. *Packing of Meat.*—The proper packing of meat is a very essential duty for the shippers of meat for the London market; for on its correct accomplishment, entirely depends the cleanness of the meat when exhibited for sale at Newgate or Leadenhall markets. A great and well-founded outcry has been raised by salesmen and consumers, against the state in which much of the meat has been sent, particularly from the northern parts of Scotland. So much so, indeed, that meat of equal quality, transmitted in the same ship, has been known to bring 3d. a pound less than that belonging to persons who had paid proper attention to packing; and the unreasonable part of the affair

has been, that salesmen are blamed for not realizing the same prices for the same kind of meat, when, in fact, the blame is alone attachable to the shippers themselves, on account of their own negligence and ignorance.

Carcasses should be a sufficient time slaughtered to become firm and stiff, before they be cut down to be packed. The slaughter-houses should be immediately washed out and ventilated, to promote the firming of the meat. Beef ought to hang from thirty to forty hours, and mutton twenty, according to the season of the year and the state of the weather, before either can be firm enough to be packed; whereas some shippers in order to hurry off their quota of meat, by the steam-vessel, pack the carcasses together in a warm state. Others press, perhaps, half a ton of meat into one box, which being insufficiently constructed, goes to pieces on being removed from the ship or waggon, and the meat thrown down upon the street in a shocking state of filth. Nay, in order to save a paltry expense, a shipper from a northern port has been known to send carcasses of beef, stuffed full of carcasses of mutton, as many as nine in one of beef, wrapped in dirty matts. When these expedients are resorted to, there is no wonder that much of the meat that reaches London from Scotland, should excite disgust, in its heated, bruised, and stained state, and indisposition shewn to have any thing to do with it on the part of those to whom it has been consigned.

The packages which are usually sent with meat are too large, even those baskets from Edinburgh and Leith, which contain six or seven carcasses of mutton, or six or seven cwt. of beef. Their capacity contains too much meat to be packed together in one space, without incurring the risk of injury, by bruising, staining, and heating. Those heavy weights create much trouble in getting them on board ship, or from the ship to the waggons and carts in London, where the crane is obliged to be used, and much time consumed in the mere transference of them to market. Frequently the upper packages on the waggons are thrust down to the street from a height of eight or ten feet; and should any of the baskets or other packages ever yield or break from the superincumbent pressure, the meat will no less be bruised than by the fall to the ground. Some reformation

in this respect is absolutely necessary to be adopted by the shippers, in order to remove obloquy from a trade which doubtlessly confers benefits on both countries, and to uphold, by judicious management, the deservedly high character which Scotch meat has acquired in London.

As a means of promoting this reformation, we would recommend that all meat should be sent in baskets, their lightness, elasticity, and handiness being superior to wooden boxes of the same strength and probable durability. They should not be larger than to contain three carcasses of mutton or pork of 80 lb. each. Their length should be that of the carcass, and their breadth so as to contain three carcasses on a tier, which a depth of fifteen or sixteen inches will be able to do. In such baskets a hind-quarter of beef, with the fore and middle rib pieces, could be packed. The beef or mutton would only thus exceed a little more than two cwt.,—a weight which two men could easily move about, and carts convey away. Each carcass of mutton or pork, or pair of hind-quarters of mutton, or hind-quarters of beef, rumps and loins, or fore and middle ribs, should be enveloped in stout, clean, dry linen cloth. The pieces should be packed into the basket in an even and firm manner, to prevent twisting or friction; and if any space is likely to occur, it should be filled up with hard wheat straw, free from dust and chaff. Were these precautions invariably used in sending meat to London, at least a halfpenny a pound would be gained on its price, and the meat arrive in good marketable order; and there is no manual difficulty in the whole process to prevent any shipper adopting them. The packages of meat sent to London from the country parts of England are not heavier than the basketfuls we have recommended.

5. *Stowing Meat on Board Ship.*—Although the shipper may technically have little control in stowing the cargo of a vessel, that being under the immediate charge of the first mate, yet if he knows what is the best method of stowing, he may gain his object by direct agreement before the shipment of his goods; and especially as he is charged extra freight for meat, at least double that for ordinary goods, it being considered a perishable commodity, he has a sort of right to see that his packages should not be placed in the worst possible position in the

ship. They should, if possible, be kept on deck, for the benefit of coolness and air; but if that is impracticable under the circumstances, then in that case they should be placed in a cool, dry situation below,—and in winter meat in that situation will long keep fresh and sweet. In no situation, whether above or below deck, ought they to be placed near the furnaces or funnel; and in case of shipping seas, they should be placed on dunnage at least four inches in height from the deck, and covered with tarpaulins; for nothing stains and extracts the juices from meat so rapidly as sea-water.

6. *Stowing Live-Stock on Board Ship.*—The steam-vessels which navigate the Irish Channel are much better fitted up for the conveyance of live-stock than those on the east coast. They have a spacious deck above, and twin decks below, so that generally they have accommodation for a large number of animals. Stalls are erected for cattle, and pens for sheep and pigs. Rings are placed, to which the cattle are fastened, who have as much liberty as to yield to the motion of the ship, and stand up together. The ventilation is also complete between decks, where of course cattle and pigs are more comfortable in coarse weather. The stock it is true arrive in London in the vessels on the east coast in good order, although they do not there enjoy the same accommodation and fitments as in the Irish vessels, nor are the fastenings of cattle so secure. Our opinion is, however, that more than two fat oxen should not stand together, and both fastened with chains or new ropes; nor should more than twenty sheep or pigs be confined in the same pen. When larger numbers are congregated together, they run the risk of being smothered, in case of falling down by the motion of the vessel. In this way, at one time, upwards of 100 sheep were smothered in the passage from Hull to London, and frequent instances of smothering, to a smaller extent, have occurred on board steam-vessels. A man should be appointed to superintend every thirty cattle, and another the sheep. Cattle would be allowed a stone of hay, and about five gallons of water each, every day. Clover may be given to sheep in summer, and to cattle always hay and water. In winter, sheep get hay, which can be slung for them in racks attached to the side of the ship. Should the voyage exceed two days, they should be

supplied with water in small troughs, which could also be hung up against the pens: but sheep never consume much food on board ship. Pigs are easily fed on board ship on raw potatoes, and a little water.

After a pretty mature consideration of exportation of live-stock by steam to London, we are convinced, that ultimately, that will be the prevailing mode of transmitting all the cattle, lean and fat, from the eastern and northern counties of Scotland to England. The fat stock will of course be sent direct to London, whilst the lean will find a suitable outlet at Hull, as being perhaps the nearest point to the pastures of Yorkshire, Leicestershire, Lincolnshire, Norfolk, and Essex. The only barrier against the *immediate* adoption of this trade, is the high freights charged by owners of steam vessels. We do not mean even to insinuate that the present freights are higher than the owners can afford to exact, but we think, that were they to encourage exportation of stock by steam at all seasons, by a reduction of freights, they would ultimately secure to themselves a source of uninterrupted employment; and when the trade was entirely established in all its bearings, which it is not yet, it would prove profitable to all the parties engaged in it, and none of them would afterwards be disposed to relinquish it. We appeal to the present stock-trade from Ireland by steam-vessels in justification of our opinion, in pursuance of which, hundreds of cattle and sheep are daily transported in all states of condition, to various ports in England, whence to be removed, either to the shambles, or feeding courts, or pastures in the interior. Since Scotland is similarly situated as Ireland in regard to the over-production of stock for the consumption of her own inhabitants, what is to prevent her prosecuting the same kind of trade, in proportion to her capabilities, and if the conveyance of stock affords profit across the Irish channel (which it certainly does, or so many dealers and shipowners would not continue in it so long from so many ports,) what is to prevent a similar trade from affording profit in the German Ocean?

But let freights continue as they are, we maintain that dealers in cattle would derive more profit in sending them to the English markets by steam than by land. For we have seen that cattle of ordinary weights of 50 imperial stones, lose as much as

6 stones in travelling to Barnet: heavier cattle will lose more; and lighter less, so that quantity may safely be taken as the average loss; but it is objected to this conclusion, that there are more cattle sent by land under than above 50 stones. Still we say, that is chiefly occasioned, if it be the fact, by the circumstance of all cattle that are obliged to be travelled on foot, being kept in a lean state; but now that the fat market is ready to receive fat cattle by steam at all times, and when the desire of Scotch agriculturists is evidently to conjoin the separate profits of the breeder and feeder, much more fat will yearly be prepared for arket, than has been the practice heretofore. Now, it is commonly believed, that about 20,000 cattle are annually reared over and above the local demand in the counties on the eastern coast of Scotland. We have seen, that cattle sent by steam, only lose about 2 stones, but by superior arrangement and accommodation they may lose even less during the few hours embracing a London voyage. We have also seen that this loss leaves a difference of 4 stones each in favour of steam conveyed cattle, which over 20,000 cattle at 7s. 6d. a stone, leaves a balance of L.30,000 in favour of the transport by steam, after paying the expenses of travelling by land; and were the expenses of travelling by land and water equal, this large sum would, of course, belong to the dealers; but were the water carriage by all that sum dearer than the expenses by land, still that sum being saved on the condition of the cattle, is ready to meet the extra charge of steam conveyance. To this consideration must be added, the superior value of the meat transported by steam, which is equivalent to 6d. per stone, and which, over the above number of cattle of 48 stones each, 2 stones being lost, would leave for the dealers L.24,000 more. The same reasoning will apply to the saving of mutton, by transporting sheep to the fat market of London, or the grazings of England; but as we know of no estimate of the numbers of sheep annually sent from the eastern coast of Scotland to England, we need not annoy our readers with imaginary calculations.

But if steam-navigation effects a saving in the deterioration of the flesh of animals, it is immaterial, in a national point of view, whether that saving is a pecuniary benefit to the class of dealers or of shipowners; but it is a substantial benefit and sav-

ing to the inhabitants of London in particular. For it will be admitted, that a regular supply of well-fed meat is an advantage to the inhabitants of any town, whatever may be the price exacted for it; and had it not been for that regular supply from Scotland in 1836, when fat stock was scarce in England, the prices of butcher's meat would then have probably risen to an unprecedented height in London. Even under ordinary circumstances it is apparent, that since the supply of meat by steam, the price of butcher meat has fallen from 7d. to 6d. a-pound in London,—that is fully 14 per cent. Now, the weekly consumption of butcher's meat, according to the data furnished by Mr M'Culloch,* amounts to L.75,000; then a weekly saving of 14 per cent. on that sum gives at least L.10,000, which is more than half a million a-year saved on this article of consumption.

As we have endeavoured to make this paper as practically useful as we could, under the limited data which we have been able to collect, we shall subjoin the amount of dues and wharfage exigible on exporting live-stock and meat to London; and also a list of the names and addresses of a few respectable salesmen in London known to ourselves.

The Shore-Dues exacted in the ports of Scotland vary exceedingly, some ports charging nothing for live-stock, whilst others charge very heavy dues; but the amount of this impost can be easily learned by any shipper. The wharfage in London is very heavy on live-stock,—a single ox paying as much as 5s. at one wharf, and only 3s. at another: 5s. do not appear an exorbitant charge, when cattle have to be brought ashore in lighters; but when they merely step ashore, it is certainly too high an impost. Suppose a steam-vessel carries up 80 cattle to London, L.20 must be paid for merely permitting them to step across, or, at most, standing for an hour in a wharf. The commission charged by salesmen in Smithfield for cattle of all weights is 4s. a-head. and 6d. for sheep. Out of this charge, the salesman pays 6d. for each ox, and 1s. 6d. per score of sheep to the banker or money taker. He pays, besides, 6d. each ox for tolls and drover, which leaves a clear commission to himself of 3s. a-head for oxen and 5d. a-sheep. The salesman of meat in New-

* Commercial Dictionary, art. Cattle.

gate, Leadenhall, and Whitechapel markets, charge one penny per stone of 8 lb. on beef, and 9d. each sheep if under 18 lb. a quarter, and one penny per stone of 8 lb. in addition, if the sheep is above that weight. Lambs are charged 9d. each, and pigs 1s. each. The salesmen pay all expenses that are incurred after the meat comes into their custody.

We ought to mention that "no salesman, broker, or factor, employed in buying for others, shall buy for himself in London or within the bills of mortality, on penalty of double the value of the cattle bought and sold.—(31st Geo. II, c. 40)"*

Live-Stock Salesmen in London, with their Addresses where they transact Business:—

Messrs Guerrier and Giblett, cattle and sheep salesmen, 8 West Smithfield.
... Duckworth and Sons, cattle and sheep salesmen, 11 West Smithfield.
... William Vorly and Son, cattle salesmen, 41 West Smithfield.
... Walker, cattle salesman, 8 West Smithfield.
... Daniel Maydwell, cattle salesman, 11 West Smithfield.
... Thomas Evans, cattle and sheep salesman, 15 West Smithfield.
... William Collins and Son, cattle and hide salesmen, 60 West Smithfield.
... Robert Hammond, cattle salesman, 17 West Smithfield.
... Langford and Elliot, cattle salesmen, 41 West Smithfield.

Meat Salesmen.

... Stubbing and Hammond, 2 Newgate New Market.
... Duckworth and Kennedy, 31 Newgate Market.
... Challis, Harris, and Lee, Newgate and Leadenhall Markets.
... Pocklington, Frackelton, and Jury, 8 Newgate Market.
... Richard Hicks, 11 Newgate Market.
... John and Ebenezer Wood, 10 Newgate New Market.
... Thomas Bonser, 17 Northampton Square, and Rose Street, Newgate Market.
... B. Chandler and Sons, 133 St John Street, and Newgate Market.
... Edwards and Walker, 2 Newgate Market.
.. Scales and Co., 4 Newgate New Market.
Benjamin Stubbing, Leadenhall Market.
ales and Son, 44 Aldgate High Street.
Samuel Jutsum, 64 Aldgate High Street.
Daniel Cork, 18 Leadenhall Market.
William Cooper, Prince's Row, Newport Market.
.. Peacock and Nottige, Newport Market.

* M'Culloch's Commercial Dict. Art. Cattle.

Poultry and Game Salesmen.

Messrs Ebenezer Howard, Leadenhall Market.
... George Bowles, 20 Newgate Street.
... William Hayes, 7 and 8 Newgate Market.
... Dean and Hatton, 21 Newgate Street.
... Bowles and Bewley, 4 Rose Street, Newgate Street.

MISCELLANEOUS NOTICES.

I. *Potato Experiment.*—The following account of an experiment on renewing the constitutional vigour of the potato, was sent to us by Mr George Sime, parochial schoolmaster of North Berwick, under date of 17th August 1837. It would be desirable to know afterwards how the new varieties stand cultivation.—E. Q. J. A. "Owing to the partial failure of the potato crop for several years past, it became an object of importance to try experiments with the view of restoring the constitutional vigour of that excellent esculent. Last year Mr Arthur, gardener at North Berwick Lodge, noticing a field of thriving potatoes, of sorts, in his neighbourhood, bestowed considerable pains in crossing the strongest and most approved varieties in the field, and afterwards carefully collected the seed. The seed thus collected was sown early this season, and the plants thus produced were in due season transferred to new ground, on which potatoes had never been grown. The crop, which covers more than a quarter of an acre, has the most promising appearance, the stems being nearly as strong as the best fields in the neighbourhood grown from sets. From the pretty extensive scale in which the experiment has been made, and the scientific manner in which it has been conducted, it seems well deserving the attention of the agriculturist, as a great number of new and important varieties may be obtained, no two stems exhibiting the same characteristics."

II. *The Value of the Precious Metals of France compared with those of the same Denomination of England.*—The price of gold at Paris is 3434 francs the kilogramme, the premium on which is 12 francs the kilogramme, making the price of gold at Paris in all 3446 francs the kilogramme, which, when reduced to English money and weight, is about equal to L. 4 : 0 : 8 the ounce; and comparing the price of gold at Paris with the price of the same metal in London, which, as regulated by the Mint, is valued at L. 3 : 17 : 10½, shews that the gold of France, though admitted in all respects to be much inferior to that of British manufacture, is 2s. 9½d. per ounce dearer. The silver is valued at 118 francs the kilogramme, and the premium on that metal being 7 francs the kilogramme, gives the price as 125 francs the kilogramme, which, when reduced to English money, in weight is about equal to 2s. 11d. the ounce, and shews that the silver of France is lower in value per ounce than that of England by 1s. 11d., the price of silver in England being 4s. 10d. the ounce. It will appear, however, by classing both metals together, viz. the gold and silver of France, the price of which per ounce, as embodied together, is L. 4,

3s. 7d., and comparing it with the same metals of England, and also classed in the same way, the price of which per ounce is L.4 : 2 : 9, shews that, on the whole, the gold and silver of France is 10d. per ounce dearer than that of England; as separated, the gold of France is 2s. 9½d. per ounce dearer than that of England; and the silver of England 1s. 11d. per ounce dearer than that of France.

III. *Relative Purity of English and French Gold and Silver Coins.*—In both denominations our sovereigns and shillings are more free from alloy than those of our neighbours. Thus, of 1000 parts in the French coin, there are only 900 pure gold, and 100 copper, whilst a sovereign contains 916.67 pure gold, and only 83.33 silver and copper. The five franc piece, likewise of 1000 parts, contains 100 copper and 900 pure silver, whilst the shilling contains 925 silver and 75 copper. The assay of English jewellery is not given, but that of French contains only two-thirds of pure gold, being as 750 to 250 copper, and the silver plate has 950 to 50 copper, being less alloy than would seem from such dark-looking metal.

IV. *Population of Cities and Towns in British India.*—The city of Calcutta is computed to contain 265,000 inhabitants; the town of Madras, 160,000; the town and island of Bombay, 162,570; the town and island of Singapore, 25,000; the town and island of Penang, 57,400; and the town and territory of Malacca, 33,800; making a total in these six places of 703,770. The following is the number of British firms, at the several ports of British India:—Calcutta, before the failure in 1830, 50, at present 62; Bombay, 17; Singapore, 15; Madras, 10; Penang, 2. To these, perhaps, we ought to add Canton, where a large body of English merchants are settled, amenable to a certain extent to English laws. We have here no less than eleven English firms, some of them very wealthy, besides six American houses of great respectability, and a considerable body of Persee merchants, who are British subjects. —*Sketch of the Commercial Resources and Monetary and Mercantile System of British India.*

V. *Density of the Population of England.*—It is a remarkable fact, that the more dense the population is in England as to numbers upon every square mile, the proportion of births to any given number of marriages varies inversely. Thus, according to the mean average of the population of England, from the returns of 1811 and 1821, where the inhabitants are found to be on the square mile, from 50 to 100 (in 2 counties) the number of births to

100 marriages was	420
100 to 150 (in 9 counties)	396
150 to 200 (in 16 counties)	390
200 to 250 (in 4 counties)	388
250 to 300 (in 5 counties)	378
300 to 350 (in 3 counties)	353
500 to 600 (in 2 counties)	331
4000 and upwards (in one county)	246

VI. *The Married and Unmarried.*—Some very curious facts on the subject of marriage, as connected with longevity, are stated by Dr Casper, in a paper of his lately published at Berlin. It had been long ago vaguely asserted, that bachelors are less long-lived than married men. Hufeland and Depar-

cieux were of this opinion; and Voltaire observed that there were more suicides among those who had not given hostages to fortune than among those who had. Odier, however, was the first who set on foot the inquiry with exactitude, and he found (Bibl. Britannique, 1814) that, in the case of females, the mean duration of life for the married woman of 25, was above 36 years; while for the unmarried it was about 30½. At 30 there was a difference of four years in favour of the married; and at 35 two years, and so on. It may be said, perhaps, that married females ought to be considered as picked lives; but, as Dr Casper observes, this is far from being generally the case, especially in the middle and upper classes of society; it is chiefly among the lower orders, where a livelihood is procured by labour, that importance is attached to the bodily health and vigour of the female. With regard to men, we gather from Deparcieux's and the Amsterdam tables, that the mortality of those from 30 to 45 years of age is 27 per cent. for the unmarried, while it is but 18 for the married; and that for 41 bachelors who attain the age of 40, there are 78 married men. The difference becomes still more striking as age advances; at the age of 60 there are but 22 unmarried men alive for 48 married; at 70, 11 bachelors for 27 married men; and at 80, for the 3 bachelors who may chance to be alive, there are 9 Benedicts. The same proportion very near holds good with respect to the female sex; 72 married women, for example, attain the age of 45, while only 52 unmarried reach the same term of life. M. Casper, in conclusion, considers the point as now incontestibly settled, that, in both sexes, marriage is conducive to longevity.

VII. *Propagating Apple-Trees.*—A new plan for increasing plantations of apple-trees has lately been carried into extensive practice by the horticulturists of Bohemia. Neither seed nor grafting is required. The process is to take shoots from the choicest sorts, insert them in potatoes, and plunge both into the ground, leaving but an inch or two of the shoot above the surface. The potato nourishes the shoot, while it pushes out roots, and the shoot gradually grows up and becomes a beautiful tree, bearing the best fruit, without requiring to be grafted. Whatever may be the success of the undertaking, its novelty at least is an inducement to give it a fair trial.

QUARTERLY AGRICULTURAL REPORT.

August 1837.

The most striking circumstance, to those who feel an interest in the crops, is the state of the weather for the last half year. The temperature of the winter was uniformly cold, the thermometer seldom ranging above 45° in the day. The spring was equally cold, with a low temperature during the day, and frost almost every night. The consequences were alarming. The fodder was nearly exhausted in keeping on the stock after the turnips were consumed. There was no vegetation; and, of course, no green food for ewes and lambs, which were overtaken with great mortality. So late as the end of May there was no spring in the grass; the spring-sown corns, although sown in a dry bed, were scarcely brairded, and the wheat land in many instances appeared red, whilst in the best si-

tuations none of it covered the clod. But after 9th June a change came over the face of the earth. Vegetation burst into luxuriance, and, in the course of two or three weeks, every plant and tree was as vigorous as if it had been growing and covered with foliage for months. The temperature seldom exceeded 65° in the day, but never below 55° in the night. This unprecedented equability of temperature, night and day, conjoined with the brightness of the sun veiled with thin vapours, encouraged vegetation to a degree that we never before witnessed. The consequences were cheering. There was soon plenty of food for every living creature; a heavy hay crop was cut down in not much beyond its usual time. The spring sown crops, particularly barley, grew at the rate of an inch a-day; the turnips were sown, and brairded almost in the instant; and the whole fields hastened towards maturity of growth in an incredibly short time. Now, while we write, 23d August, harvest is already begun in some of the earliest spots, and next week it will be pretty general; and all this has come to pass when, only three short months ago, it was considered impossible to reap corn, under the most favourable circumstances, before the end of September! So short-sighted is man and distrustful of the goodness of Providence! We hear favourable accounts of the bulkiness of all kinds of grain crops. Turnips could certainly not get finer weather. The pastures continue fresh, from the dropping rains. The potatoes present no failures. The heavy thunder showers in the end of July laid much of the heavy grain crops, but there is no doubt of their filling in this genial weather. Of course, we can as yet pass no opinion on what the quality of the grain is likely to be.

Many collateral subjects would have had their due share of attention, had there been space, but we are again curtailed in that respect, and must reserve what we have to say for a more convenient opportunity.

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarter and Years ended on the 5th of July 1836, and 5th of July 1837,—shewing the Increase and Decrease on each head thereof.

	Quarters ended July 5.		Increase.	Decrease.	Years ended July 5.		Increase.	Decrease.
	1836.	1837.			1836.	1837.		
	£	£	£	£	£	£	£	£
Customs, ..	4,842,887	4,480,385	..	412,502	19,167,127	19,290,605	123,478	..
Excise,....	3,215,069	2,663,564	..	551,505	12,433,519	12,163,800	..	269,719
Stamps,...	1,734,267	1,647,039	..	87,228	6,722,902	6,583,771	..	139,131
Post-Office,	376,000	356,737	..	19,263	1,459,000	1,471,737	12,737	..
Taxes,....	1,571,150	1,609,409	38,25	..	3,690,980	3,720,175	29,195	..
Miscellaneous,	7,974	5,727	..	2,247	62,806	48,174	..	14,632
	11,747,347	10,762,861	38,259	1,072,745	43,536,334	43,278,62	165,410	423,482
	Deduct Increase,			38,259	Deduct Increase,			165,410
	Decrease on the quarter,			1,034,486	Increase on the year,			258,072

TABLES OF PRICES, &c.

age Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets :—

LONDON.

heat.	Barley.		Oats.		Rye.		Pease.		Beans.	
d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
10	33	4	23	4	34	6	38	2	36	7
2	30	5	23	5	35	1	37	10	33	11
11	29	9	23	0	36	6	38	2	34	6
5	29	8	24	2	35	10	35	3	35	5
0	30	3	25	0	35	2	37	6	36	7
1	30	11	24	11	35	8	38	10	36	11
3	29	7	25	2	34	1	40	6	37	10
9	29	0	24	10	36	6	40	2	39	4
1	27	5	25	0	37	2	41	4	38	6
6	27	2	24	0	36	4	41	9	36	10
0	26	11	23	6	36	0	40	9	41	1
9	27	5	23	11	35	2	39	6	39	7
9	34	5	23	5	36	6	41	4	37	6

DUBLIN.

[illegible]	Wheat Per Bar. 20 St.		Barley Per Bar. 16 St.		Bear Per Bar. 17 St.		Oats Per Bar. 14 St.		Flour Per Bar 9 St.	
1837.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
May 5.	36	0	17	6	17	2	14	0	18	0
12.	35	0	17	0	17	4	14	3	18	0
19.	35	6	17	3	17	0	14	6	17	6
26.	35	6	18	0	16	8	15	0	18	6
June 2.	36	6	17	6	16	10	15	6	19	0
9.	37	0	17	6	17	0	15	0	19	0
16.	36	0	18	0	17	4	14	10	18	6
23.	34	0	15	6	17	6	14	6	18	3
30.	34	6	15	3	17	8	14	6	18	0
7.	34	0	15	0	17	9	14	0	18	8
July 14.	33	6	14	3	18	1	14	6	18	3
21	33	0	14	0	18	8	13	6	18	0
28.	33	6	14	6	18	9	14	0	18	3

LIVERPOOL.

[illegible]	Barley.		Oats.		Rye.		Pease.		Beans.	
d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
2	33	4	22	6	35	2	37	6	41	2
6	30	1	22	7	35	6	39	6	40	10
10	30	0	22	11	35	1	38	2	42	3
10	28	10	24	4	35	8	39	10	41	10
1	29	2	25	7	35	6	39	2	42	11
9	33	7	25	6	35	5	38	10	42	2
9	28	3	25	8	36	1	40	2	43	1
8	33	3	25	8	36	6	39	8	42	6
5	34	6	26	0	37	2	40	10	43	4
8	34	6	25	4	37	6	42	0	43	10
0	28	11	22	4	36	6	44	8	42	0
10	28	0	22	5	35	6	40	2	42	3
3	30	6	22	5	36	8	42	6	44	4

EDINBURGH.

Date.	Wheat.		Barley.		Oats.		[illegible]		Beans.	
1837.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
May 3.	58	0	32	9	29	10	44	0	45	0
10.	57	3	31	6	29	4	42	0	41	6
17.	56	10½	31	0	29	1	40	0	40	3
24.	57	6	31	8	30	8	40	0	40	0
31.	59	6	32	0	32	3	40	6	41	0
June 7.	60	11	33	0	33	8	41	8	42	0
14.	61	8	32	9	33	8	41	6	41	9
21.	58	6	33	0	32	8	41	6	42	0
28.	57	8	33	4	31	2	41	0	41	6
July 5.	56	2	33	0	31	0	41	6	41	8
12.	58	0	32	6	30	2	41	6	41	8
19.	60	4	33	0	30	6	43	0	42	2
26.	61	8	33	0	30	4	41	6	42	0

: shewing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th 'V. c. 58, and the Aggregate Averages which regulate the Duties payable on FOREIGN V; the Duties payable thereon, from May to June 1837.

Wheat.				Barley.						Oats.						Rye.						Pease.						Beans.					
Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.	
s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
55	11	31	8	30	6	31	2	15	4	23	5	23	10	13	9	33	4	34	10	18	3	38	2	39	10	15	0	37	8	37	3	14	0
55	9	31	8	29	6	30	11	16	10	23	5	23	0	12	3	31	6	34	6	18	3	34	1	37	3	14	0	38	5	37	6	14	0
55	6	31	8	29	3	30	5	16	10	23	4	23	1	12	3	35	6	34	4	18	3	37	7	37	7	14	0	37	9	37	7	14	0
55	1	31	8	28	10	30	0	16	10	23	1	23	2	12	3	31	11	34	9	18	3	37	9	37	9	14	0	37	7	37	7	14	0
54	11	32	8	28	7	29	7	18	4	24	0	23	3	13	3	33	2	34	7	18	3	39	3	38	2	12	6	38	9	37	9	14	0
55	0	31	8	28	8	29	3	18	4	24	10	23	8	13	3	33	8	33	0	16	9	38	8	38	3	12	6	39	3	38	9	12	[illegible]
55	1	31	8	29	5	29	1	18	4	25	0	23	11	12	3	35	11	35	1	16	9	40	0	39	8	12	6	39	6	38	6	12	[illegible]
55	2	31	8	28	8	28	11	19	10	23	4	24	3	10	9	35	4	35	3	16	9	41	0	39	2	11	0	40	2	39	0	12	[illegible]
55	7	31	8	28	9	28	10	19	10	23	4	24	7	10	9	37	9	35	6	14	0	41	1	39	9	11	0	40	9	39	3	11	0
56	2	30	8	28	9	28	10	18	11	23	6	24	0	9	3	34	3	33	3	16	0	40	9	40	3	9	6	40	7	39	9	11	0
56	6	30	8	28	3	28	9	19	10	24	7	23	1	9	3	34	8	33	6	16	9	40	10	40	6	9	6	39	11	40	1	9	[illegible]
56	6	30	8	29	0	28	10	19	10	24	3	25	0	9	3	35	8	33	8	16	9	39	7	40	7	9	6	40	9	40	4	9	[illegible]
56	7	30	8	29	0	28	7	19	10	24	1	24	10	10	9	31	10	33	8	16	9	40	4	40	7	9	6	41	0	40	6	9	[illegible]

The MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Quantitie[s] Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quanti[ties] upon which duties have been paid for home-consumption, during the same Month; and the Qua[n]tities remaining in Warehouse at the close thereof, from 5th May to 5th July 1837.

Month ending	IMPORTED.			CHARGED WITH DUTY.			REMAINING IN WAREHOU[SE]		
	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Tota[l]
May 5. 1837.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs.
Wheat, . .	11,997 0	..	11,997 0	1,290 6	1,365 5	2,656 3	462,627 0	24,736 3	487,3[illegible]
Barley, . .	7,360 0	..	7,360 0	1,762 0	..	1,762 0	24,208 6	..	24,2[illegible]
Oats, . .	13,278 7	..	13,278 7	142 3	..	142 3	239,032 5	..	239,0[illegible]
Rye, . . .	3,522 1	..	3,522 1	27 7	..	27 7	3,262 6	..	3,2[illegible]
Pease, . .	12,003 1	..	12,003 1	2,405 2	..	2,405 2	20,215 3	..	20,21[illegible]
Beans, . .	4,992 5	..	4,992 5	1,359 0	..	1,359 0	14,503 0	..	14,50[illegible]
Totals, .	53,153 6	..	53,153 6	7,287 2	1,365 5	8,352 7	763,848 4	24,736 3	788,5[illegible]
June 5.									
Wheat, . .	49,155 0	..	49,155 0	5'6 3	1,675 1	2,001 4	502,715 3	23,499 1	526,21[illegible]
Barley, . .	8,190 5	..	8,190 5	147 5	..	147 5	29,683 2	..	29,6[illegible]
Oats, . .	12,181 4	..	12,181 4	67 2	..	67 2	248,421 7	..	248,42[illegible]
Rye, . . .	2,308 7	..	2,308 7	..	..	..	4,344 3	..	4,34[illegible]
Pease, . .	7,165 3	0 2	7,165 5	1,547 2	..	1,547 2	25,301 2	..	25,30[illegible]
Beans, . .	4,351 6	..	4,351 6	385 1	..	385 1	18,428 5	..	18,42[illegible]
Totals, .	83,353 1	0 2	83,353 3	2,673 5	1,675 1	4,148 6	828,894 6	23,499 1	85[illegible]
July 5.									
Wheat, . .	82,913 0	222 1	83,135 1	207 3	651 5	859 0	584,434 7	23,069 5	607,5[illegible]
Barley, . .	8,975 7	..	8,975 7	..	..	..	37, 52 5	..	37,[illegible]
Oats, . .	46,764 0	..	46,764 0	4,293 7	..	4,293 7	266,294 1	..	266,2[illegible]
Rye, . . .	6,477 3	..	6,477 3	..	..	..	10,813 6	..	10,81[illegible]
Pease, . .	26,129 2	0 1	26,129 3	3,197 3	0 1	3,197 4	47,797 1	..	47,79[illegible]
Beans, . .	13,426 6	..	13,426 6	585 0	..	585 0	31,160 5	..	31,1[illegible]
Totals, .	184,686 2	222 2	184,908 4	8,283 5	651 6	8,935 3	998,333 1	23,069 5	1,021,4[illegible]
May 5.	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. [illegible]
Flour, . .	12,358 2 7	1,600 1 24	13,959 0 3	128 2 9	1,996 0 2	2,124 2 11	145,748 0 6	6,011 1 6	151,7[illegible]
Oatmeal, .	1,509 2 10	..	1,509 2 10	0 0 21	..	0 0 21	295 0 6	..	29[illegible]
Totals, .	13,868 0 17	1,600 1 24	15,468 2 13	128 3 2	1996 0 2	2,124 3 4	146,043 0 12	6,011 1 6	152,0[illegible]
June 5.									
Flour, . .	41,253 2 26	4,763 3 10	46,017 2 8	6 0 1	4,326 0 9	4,332 0 10	158,560 2 16	6,236 2 5	164,79[illegible]
Oatmeal, .	..	..	..	..	..	..	34 3 21	..	3[illegible]
Totals, .	41,253 2 26	4,763 3 10	46,017 2 8	6 0 1	4,326 0 9	4,332 0 10	158,595 2 9	6,236 2 5	164,8[illegible]
July 5.									
Flour, . .	19,707 0 7	12,894 0 16	32,601 0 23	409 3 15	1,501 3 24	1,911 3 11	154,612 1 24	17,628 2 26	172,24[illegible]
Oatmeal, .	325 2 4	..	325 2 4	2 2 20	..	2 2 20	477 0 26	..	47[illegible]
Totals, .	20,032 2 11	12,894 0 16	32,926 2 27	412 2 7	1,501 3 24	1,914 2 3	155,089 2 24	17,628 2 25	172,71[illegible]

PRICES of BUTCHER-MEAT.

	SMITHFIELD, *Per Stone of* 14 lb.		MORPETH, *Per Stone of* 14 lb.		EDINBURGH, *Per Stone of* 14 lb.		GLASGOW, *Per Stone of* 14 lb.	
Date.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1837. May,	7/6 @ 7/9	7/6 @ 8/6	8/ @ 8/5	8/6 @ 9/6	7/6 @ 8/3	7/6 @ 8/6	8/ @ 8/9	7/9 @ 8/6
June,	7/6 8/3	7/9 8/9	7/6 8/3	7/ 8/6	7/3 8/	7/6 8/	7/9 8/3	7/6 8/3
July,	7/3 8/6	7/6 8/3	7/ 8/	7/ 8/3	7/ 7/9	7/ 7/9	7/6 8/	7/6 8/

PRICES of English and Scotch WOOL.

ENGLISH, per 14 lb.—*Merino*, 25/ @ 26/; in Grease, 13/ @ 16/6.—*South Down*, 14/6 @ 19/6; *Leicester*, Hogg, 18/ @ 24/; Ewe and Hogg, 14/ @ 21/.—*Locks*, 9/ @ 11/; *Moor*, 7/6 @ 9/.

SCOTCH, per 14 lb.—*Leicester*, Hogg, 14/ @ 16/6; Ewe and Wether, 12/ @ 14/6.—Ewe, 10/6 @ 12/: *Cheviot*, White, 9/ @ 12/; Laid, Washed, 7/6 @ 8/6; Unwashed, 6/6 @ 7/; *Moor*, White, 6/ @ 7/; Laid, Washed, 5/3 @ 6/ Unwashed, 4/6 @ 5/.

THE QUARTERLY JOURNAL OF AGRICULTURE.

ON RAILWAYS.

By William Galbraith, M. A., and M. S. A., Edinburgh.

The importance of a ready and cheap mode of conveying goods and passengers from one place to another is now so well understood and duly appreciated, that the demands for canals, and more especially for railways, has of late increased to an unprecedented degree.

The immense benefit derived from the use of steam-boats on our sea-coasts, friths and rivers, has long attracted attention, and they have become the means of opening up a communication with the more remote corners of our island; so that places which could formerly be reached in the course of several days, can now be visited in a few hours, thus affording a vast variety of easy pleasure trips to our tourists, the carriage of various articles of manufacture, and the produce of the soil to all parts of the kingdom.

During a number of years past, canals, of various dimensions, have been advantageously used for the conveyance of goods, and partially for passengers; and for this purpose they are well fitted when a saving of time is not of much importance. But when expedition is required and a quick transit is of vital importance, the superiority of the railway, constructed on proper principles, is indisputable. The superiority of a railway over a turnpike road as at present constructed, will be obvious, when

it is known that they give the certainty of the turnpike road in transit with the advantage, in ordinary cases, of saving seven-eighths of the power; that is, one horse on a railway will produce as much effect as eight horses on a turnpike road.* On a good railroad the effect produced by a given power is nearly a mean between the turnpike road and the canal when the rate of travelling is about three miles an hour; but when great speed is necessary the railway in effect may either equal the canal, or even far surpass it. No doubt the construction of canals, roads, and railways is expensive, but if a fair return be received for the outlay of the proprietors, which in judiciously managed speculations will be the case, this can form no objection.

The schemes and prospectuses for railways are, however, at the present time so numerous, while the advantages held out to subscribers are so doubtful, that it seems to be a duty incumbent on those who possess a moderate share of scientific knowledge, to examine their pretensions and expose their real properties. Indeed, the subject appears to be so important as to demand a large share of the attention of the Legislature, to prevent such a crisis as happened in the year 1825, which the present aspect of affairs seems but too clearly to forebode. This will not appear to be an exaggerated statement, when it is well known that, in many instances, railways are projected by solicitors, attorneys, &c. in combination with engineers anxious for business or ambitious of prominence in their profession, and are little solicitous for excellence in principle or public advantage, provided their own fees are well paid, and large profits are realized on the transfer of shares.

"The suspicion," says Colonel Mudge in his tract on Railways, "arising to the mind on taking up a book or pamphlet on railways, naturally occurs, that the writer some way or other is an interested person, either a railway speculator, an engineer, or a lawyer, in short, one who has a direct personal interest in some one of the many schemes, which having gone through all the stages of incubation, are now hatched, fledged, and, like the peacock with his spreading tail, exhibiting all their beauties and attractions to the admiring public."

"In England," says he, p. 14, "the mode of getting up a railway is well known, and the means by which it is brought to maturity is no secret. A speculator examines a good map, and, after an examination of the positions of

* It is to be hoped that great care will now be taken in the selection of the lines, as well as in the formation of the turnpike roads, so that, at no distant period perhaps, locomotive engines may be employed advantageously upon them.

the hills and valleys, draws the line, which is afterwards to be more minutely surveyed and levelled. Having provided himself with this document, and likewise being furnished with a flourishing prospectus, he gives the preference to some gentlemen of well known wealth and character, to whom he exhibits the promising undertaking. A few good names, in addition, as directors, and a popular engineer, suffice for the formation of a company very frequently; and it may be generally said, at the outset of the railway speculations, without any one of the parties, including the engineer, ever having seen the ground at all. As a matter of profit, and to induce the public to come forward in support of these undertakings, in many cases the most fallacious statements are put forth, and some of them so absurd, that it implies an almost incredible degree of credulity in the parties deceived by them.

"The fact really is, with reference to profit, that a reasonable doubt is entertained by those best qualified to form a correct judgment, whether any thing more than a *very moderate profit* will ever be realised eventually by any of the railways, either executed or now in progress, from the enormous expenses to which they will be liable, and a belief prevails that the chief part of those in contemplation, should they commence *tunnelling and cutting* according to the usual method, will be in the condition of the Thames Tunnel, with reference to the original capital long before a very moderate proportion of the work shall be done."*

To these faithful and judicious remarks of Colonel Mudge, it may be added, that when any attempt is made by an honest and accurate engineer, though, perhaps, less known, to correct defects, or disadvantageous properties, in those works proposed by engineers who consider themselves to have a kind of prescriptive right to public confidence, an appeal is straight-forward made to a friend of the same class, who considers himself in duty bound to produce a piece of special pleading, supported by exaggeration, gratuitous assumption, and fallacious deduction, in the shape of a report, erroneously called an examination of the relative merits of the two lines of railway, and invariably gives the preference to that of his friends, by whom he is employed.

In the opinion of some, it seems to be taken for granted that a circuitous line, of almost any distance, may be chosen in preference to a shorter and more direct line, provided the gradients be very good. Now there cannot be a greater fallacy than this in general, though nothing is more true in many particular instances, within certain narrow limits. For instance, a railway perfectly level might be formed between any two sea-ports, one on the east, and the other on the west coast of Britain, if carried

* This tract of Colonel Mudge, of the Royal Engineers, ought to be carefully studied by all those connected with railways.

along the sea-shore, though in many cases the adoption of such a line would be absurd, and, because this is an extreme case, its fallacy is readily detected. But the same objection may be, and really is, applicable to many railways now in contemplation, though not in so great a degree, and is therefore less easily perceived. Indeed, it is admitted that a greater tonnage may be propelled along the longer and more level line *with the same velocity* as a less tonnage on the line possessing higher gradients, and of a smaller distance, with locomotive engines of equal power; but then it is clear that a saving of time on the shorter line may do as much, and often does more than counterbalance the greater load on the former. Suppose, for example, that two railroads join two extreme points, one of which is *two miles* long, with steeper gradients than another of *three miles* long with easier gradients, in such a manner that, on the shorter, a locomotive engine can propel a load of *two tons* at the same velocity as an equal powered locomotive engine can propel a load of *three tons* on the longer line, then the train would pass *three times* along the shorter line, in the same time that the equivalent train would pass *twice* along the longer line, that is, each of the trains would transport six tons between the extreme points in the same time, while, by adopting the shorter line, one mile, or one-third of the expense of the longer line, would be saved, without losing any part of the effect. Again, by reason of bad curves causing great centrifugal force, thereby rendering the trains liable to run off the rails, improper position, and numerous other casualties, a long line, though nearly level, may be so much inferior to a shorter line, with comparatively less favourable slopes, as to admit of no sort of comparison, in point of utility and judicious construction. The advantages, therefore, to be derived from the use of railways, are rapidity of transit and economy of charge, to accomplish which the following principles should be kept constantly in view:—

1. One of the conditions which must not be departed from in laying out great lines of railway is, that those lines may be traversed throughout their whole extent by locomotive engines, and, in order to avoid as much as possible interruptions and delays, that the same engine should draw the same train.

2. Another condition is, to diminish, as much as possible, the time of transit between two given points, by reducing the length

of the railway. In this case, the straight line, either horizontally, or having one uniform slope, will be the most advantageous. It is this line which ought to be selected, or the nearest practicable one to it, both horizontally and vertically.

3. It would be a great error to suppose that the line may be lengthened circuitously; because, from that means, by getting easy gradients, the velocity will be much increased, since what is gained in velocity, it is obvious, may be easily lost in greater distance.

4. It was formerly supposed (and the hypothesis has been acted on by many engineers) that the entire line of railway should, as nearly as possible, have one uniform slope, with very good gradients, however circuitously almost the line might be made to obtain them.

5. Now, within certain limits, this is doubtless true, but it requires great care, and more science than falls to the lot of most engineers, to be able to determine these with tolerable accuracy.

6. It has also been a maxim with some engineers, that if a uniform slope is impracticable, or if it requires too great a deviation from the straight or direct line, it is necessary at least to endeavour to rise progressively from one extremity of the line to the other, and never to ascend where the line must descend again.

7. These views in art. 6. have been too frequently advocated and acted upon, to escape the observation of those engineers possessing the requisite information, and their fallacy was not likely to remain long unexposed.

8. Accordingly, Baron Prony de l'Ecole des Ponts et Chaussées, at Paris, reflecting on some of them, pointed out their erroneous nature to M. Navier, who had published a tract, "On the means of comparing the respective advantages of different lines of Railway, and on the use of Locomotive Engines."

9. It is clear that if the traction be increased by gravity, when an engine is impelled *up* an inclined plane, in proportion to the rate of rise, it will be diminished in the same proportion when it descends, especially when the gradients are very good, never exceeding 1 in 300, and generally much less, in which circumstances they do not require the use of the break.

10. On this principle the loss of velocity in ascending one side of a rising ground will be nearly, but not exactly, as will be after-

wards shewn, compensated by the gain in descending the other when the slopes are equal, and some aliquot part of it regulated by the difference, if they are unequal, and this compensation will be the more nearly equal, the better the slopes are and the more perfect our engines become.

11. On some such hints as these from M. Prony, M. Navier's analysis* led him to the result, which is important for the establishment of railways, "That in tracing a line of railway, there is no inconvenience in rising higher to redescend afterwards, as long as that does not make it necessary to extend the limit of the slopes. Thus, for example, several lines uniting two given extreme points, upon which it is admitted that the same locomotive engine draws throughout the same train, will be perceptibly equal in respect to the expense of transit, whatever be the height to which they rise, or from which they descend, if their lengths be equal, and if upon any of these lines the steepest slopes do not surpass 1 in 200; that is, they must not be so steep as to require the use of the break. It appears, then, that especial care should be taken to diminish the length of the line of transit, and to lower the limit of the slopes."

12. It is evident that the *minimum* or least value of both these should, as far as possible, be combined, otherwise one may be improved at too great an expense of the other, by which means certain loss is undoubtedly sustained. To select the cheapest and most efficient line of railway depends upon the following proposition, which is not very easily solved:—*To combine the distance between two given points with the gradients, in such a manner as to produce the maximum effect at the minimum expense.* Though this proposition, in general, cannot be solved directly, yet, by attending to the preceding principles, an approximate solution may be obtained sufficiently accurate for all ordinary purposes.

13. In estimating the mean value of the gradients throughout a line, the value of each, with its proper sign, should be multiplied by its length, and the algebraical sum of the products divided by the length of the whole line, including the levels in the same measure, will be the mean gradient.

In this case the signs of the ascents must be positive, and those of the descents negative.†

* See Macneill's Translation, page 74, formula at foot of the page. The reasonings of Mr Barlow, &c. will afterwards be considered.

† In Mr Simm's book on Levelling, the following instances of useless ascents are given from Sir Henry Parnell's treatise on Roads:—" As one instance, amongst others, of the serious injury which the public sustains by this system of road-making, the road between London and Barnet may be mentioned, on

14. If the force of traction obtained in this way on two lines connecting the same two extreme points be inversely as their lengths; or if the product of the length of one line, multiplied by its force of traction, be equal to the product of the length of another line multiplied by its force of traction, the effects of those two lines would be equal, or equal tonnage would, by equivalent locomotive engines, be transported along each line in equal times. This follows from the fact, that if the traction on a *unit* of the line, such, for example, as *one* mile, be multiplied by the whole length in miles, the product will be the total traction throughout the line, and it will express the power expended in propelling an engine throughout the whole line. Hence the relative effective powers of two lines of railway may be easily estimated, and their respective advantages and disadvantages readily determined.

15. As the length of a line of railway is one of the elements employed to compute the expense of transit, it is clear it should be as short as convenient, and sound principles will admit. This will also reduce the time of transit, for as Navier remarks, page 8 of Macneill's Translation, " It would be committing a great error to suppose we may lengthen the line because the velocity of transport over it is great. The same principle which rendered the establishment of a railway desirable, in order to obtain a mode of transport quicker than any other, requires that the shortest lines be sought after, and even to prefer them when sometimes they appear to be disadvantageous in other respects."

16. In order to ascertain the effects of slopes, experiments have been instituted to determine the amount of tractive force

which the total number of perpendicular feet that a horse must now ascend is upwards of 1300, although Barnet is only 500 feet higher than London; and in going from Barnet to London a horse must ascend 800 feet, although London is 500 feet lower than Barnet." Now, as the *distance* by which these inconveniences might be avoided is not mentioned, no conclusion can be formed either of the judicious or injudicious formation of this road; but in the following from Mr Telford, that gentleman's abilities and sound judgment are obvious, since he both *diminishes* the height of his summit level and *shortens* his distance in the new road across the island of Anglesea, thus :—

	Height of Summit.	Total rise and fall.	Length.	
			Miles.	Yards.
	Feet.	Feet.		
Old Road, . . .	339	3540	24	428
New Road, . . .	193	2257	21	1596
Difference or Gain,	146	1283	2	592

necessary to propel a ton of burden on the level plane or horizontal line of a well constructed railway. This, of course, varies a little with the quality of the railway as well as with the construction of the carriages, and depends on the total amount of friction. In general it varies from 8 lb. to 9 lb. per ton, and is therefore very commonly assumed at 8½ lb. per ton, an approximation in the present state of railway carriages not far from the truth. Now, in one ton there are 2240 lb., consequently if 2240 be divided by 8.5 the quotient is 264. From this it is inferred that the traction on the level plane is equal to 1–264th part of the weight drawn. But, by the principles of mechanics, the weight is to the power as the length of an inclined plane is to its height. Now, suppose a waggon enters on an inclined plane, rising at the rate of 20 feet in an English mile of 5280 feet, or 1 foot in 264 feet, it follows that another 8½ lb. will be added to that on the level, or that *twice* the force will be necessary to propel the carriage with its load *up* this ascent at the same velocity as on the level; that is, if 8½ lb. per ton be required to propel a carriage or train of waggons at the rate of 20 miles an hour, it would require *double* that force of traction, or 17 lb. per ton, to keep up that velocity on a rise of 1 in 264 or 20 feet in a mile. It also follows from the same process of reasoning, that a velocity of 20 miles per hour might be kept up on that inclined plane if the train of waggons contained a part of the load only.* Again, if the rise be only 1 in 2000, it will give an additional tractive force of 1.12 lb., which added to 8.5 lb. gives 9.62 lb. the necessary tractive force up this inclination similarly as before. In this way we arrive at a distinct knowledge of the exact amount of tractive power necessary to propel any load *up an inclined plane*, whatever may be its rise per mile or inclination. This is the only true purpose to which the principle in question is applicable, though attempts have been made by engineers, not well acquainted with the scientific departments of their profession, to apply it to a very different one.†

* This is correctly shewn by Barlow, page 475, &c.

† The purpose to which we refer here is not a little singular, namely, that 20 feet of *rise* per mile is equal to one mile of distance, and that *one mile* of a railway rising 20 feet in a mile is in *every respect* equal to *two miles*, on the horizontal plane! Thus, neglecting the distance, the expenses of formation, transit, &c. on the second mile entirely.

17. If the train is moving down the descending plane, then the tractive force necessary on the level plane will be diminished by the effects of gravity to keep up the same velocity on the inclined plane as on the level.

18. If the power employed be constant, then there will be a retardation in ascending the inclined plane, and a corresponding acceleration in descending, which will, in well-constructed railways, whose gradients do not exceed 1 in 300, nearly, though not exactly, counterbalance each other.

The modifications necessary on this account will be considered in a subsequent part of this paper, though the principles already established are sufficient for ordinary purposes, and are quite adequate to expose the 20 feet assumption.

19. On the preceding principles will be compared the relative merits of two assumed lines of railway, in which the values of the respective gradients are given in decimal fractions, as being more convenient for this purpose than vulgar fractions.

LINE A.

No.	Character.	Length of Slopes in Miles.	Gradients.	Effect of Descents. —	Effect of Ascents. +
1	Level, . .	0.800	0.0	....	....
2	Descent, .	1.530	0.0005000	0.0007650	....
3	Ascent, .	2.950	0.0008333	....	0.0024583
4	Level, . .	1.736	0.0	....	....
5	Ascent, .	6.250	0.0016667	....	0.0104149
6	Ascent, .	1.143	0.0008333	....	0.0009523
7	Level, . .	1.143	0.0	....	....
8	Descent, .	1.143	0.0008333	0.0009523	....
9	Ascent, .	2.270	0.0005000	....	0.0011350
10	Level, . .	0.760	0.0	....	....
11	Descent, .	2.480	0.0008333	0.0020667	....
12	Level, . .	0.470	0.0	....	....
13	Ascent, .	8.455	0.0012500	....	0.0105688
14	Level, . .	2.600	0.0	....	....
	Length of line,	33.730 miles.		0.0037840	0.0255293
				Descents,	— 0.0037840
		Effect of the slopes ascending,			+ 0.0217453

Now 0.0217453 divided by 33.73 miles, gives 0.0006447 for the mean effect per mile. If this quotient be multiplied by

2240, the number of pounds in a ton, there results 1.444 lb. of traction from gravity per ton per mile to be added to 8.5 lb. on the level, to give the traction 9.944 lb. on the ascending plane per ton per mile. Then, if this be multiplied by the whole distance, there will be obtained 9.944 lb. × 33.73 miles, or 335.4 lb. per ton throughout the whole line. In like manner, on the descending plane returning, we get 8.5 lb. — 1.444 lb. = 7.056 lb. for the traction per ton per mile, and 7.056 × 33.73 = 238 lb. for the whole traction throughout the line.

Line B.

No.	Character.	Length of Slopes in Miles.	Gradients.	Effect of Descents. —	Effect of Ascents. +
1	Level, . .	0.875	0.0	....	....
2	Ascent, .	1.000	0.0018940	....	0.0018940
3	Level, . .	1.500	0.0	....	....
4	Ascent, .	2.000	0.0020833	....	0.0041667
5	Ascent, .	4.875	0.0023697	....	0.0115229
6	Ascent, .	3.625	0.0022723	....	0.0082371
7	Ascent, .	6.625	0.0030303	....	0.0200757
8	Descent, .	4.000	0.0030303	0 0121212	....
9	Descent, .	2.500	0.0015152	0.0037880	....
10	Descent, .	1.750	0.0024630	0.0043102	....
	Length of line,	28.750 miles.		0.0202194	0.0458961
					— 0.0202194
			Effect of the slopes ascending,		+ 0.0256770

This effect 0.025677 divided by 28.75 miles, gives 0.0008931 for the mean effect per mile. As on the preceding page 0.0008931 × 2.240 = 2.000544 lb. for the mean traction depending on gravity per ton per mile, to which 8.5 lb. being added, there results 10.5 lb. per ton per mile. This multiplied by the distance 28.75 miles, gives 301.875 lb. per ton throughout the line.

Comparing now the two lines, we have A — B on the ascent, or 335.4 — 301.9 = 33.5 lb., the gain on the second or shorter line B on ascending, which, divided by 8.5, gives a force capable of transporting a ton 3.94 miles on the horizontal plane.

On descending we have 8.5 — 2.0 = 6.5 lb., whence 28.75 × 6.5 = 186.9 lb. the whole traction.

Consequently A — B = 238 — 186.9 = 51.1 lb., which, at

8.5 lb. per mile, gives 6.02 miles on the level, and, added to the former (3.94), gives on the whole 9.96 miles on the level, or the superiority of the line of B over that of A is about ten miles each trip, that is, about twice the difference of their lengths each trip, which shews the great advantage of reducing the length of the line, provided the slopes be good, not exceeding 1 in 300, or less if possible.

20. These may be placed in a different point of view by extending the lines from the effect of the slopes.

First, for A's line ascending, there will be

Miles level.

$$33.73 + 33.73 \times \frac{1.444}{8.5} = 33.73 + 5.73 \quad = \quad 39.46$$

Secondly, for B's line ascending,

$$28.75 + 28.75 \times \frac{2.002}{8.5} = 28.75 + 6.77 \quad = \quad 35.52$$

Differences, . 1.04 3.94

Hence there is a gain for A's line, from the effect of the slopes alone, of 1.04 miles, though a loss on the whole of 3.94 miles.

Thirdly, for A.'s line descending,

Miles level.

$$33.73 - 33.73 \times \frac{1.444}{8.5} = 33.73 - 5.73 \quad = \quad 28.00$$

Fourthly, for B's line descending,

$$28.75 - 28.75 \times \frac{2.002}{8.5} = 28.75 - 6.77 \qquad 21.98$$

Differences, . 1.04 6.02

Hence, in this case also there is an advantage of 1.04 miles, from the effect of slopes *alone*, in favour of A's line, though a loss on the whole of 6.02 miles compared with B's. Consequently, though A saves two miles more than B in both ascending and descending, yet, on account of the greater length of his line, he loses ten miles level on the whole trip backwards and forwards.

Hence this conclusion necessarily follows, that A loses more in his greater distance, than he gains over B by his superior gradients. The line of B, therefore, is preferable to that of A, because it produces the same effect at less expense; that is, there is a saving of about *five miles* in the distance, for the original expenses of construction, the annual repairs, and daily charges of transit. These conclusions depend upon principles advocated by Mons.

Navier, Dr Lardner, &c. They have been somewhat modified, however, by Mr Barlow of Woolwich, whose view of this subject is perhaps rather more accurate, and, so far as we know, perhaps rather superior to any that has been hitherto proposed. These will now be considered and illustrated by an application to the same lines already introduced.

21. Mr Barlow remarks, in page 476 of the appendix to the new edition of his Treatise on the Strength of Timber, &c.— "As some difference of opinion exists on this subject (the effect of gradients), probably arising more from imperfect definition, than from any other cause, it may be well to examine the subject rather more in detail than would otherwise be requisite." He then assumes some simple instances, by which he shews that in some respects no force may be said to be lost, yet there may be *lost time*, by which a *loss of mechanical effect* is sustained.

After a good deal of reasoning and reflection on the effects of ascending and descending planes, combined with mathematical investigation, he arrives at a differential equation, somewhat troublesome to integrate, page 479, and which leads merely to a theoretical result, inapplicable to any case of real practice.*

"In page 480 he arrives at a formula from practical considerations, which perhaps gives the greatest increased speed that can, with a due regard to safety, be admitted on a descending plane; and it is, therefore, the greatest slope that can be safely descended with the steam admission valve fully open. Let us, therefore, now confine ourselves wholly to the question as limited by considerations of prudence, that is, by claiming no more advantage for the descending planes than is consistent with safety. These limitations must be somewhat arbitrary, but the following are perhaps agreeable to the usual practice.

22. "That no plane on which the train would be accelerated, with the steam wholly shut off, ought to be descended with more than the uniform horizontal velocities, and on which the break must be applied to prevent acceleration.

23. "That all those planes on which the ultimate velocity would exceed six-fifths of the original horizontal velocity, and in descending which, therefore, the admission of steam must be partly shut off, ought not to be descended with more than six-fifths of the original velocity; that is, the original horizontal velocity should not be increased more than by one-fifth of itself.

"All planes of less slope than this last, will, soon after the descent of the body commences, take up their uniform velocity without shutting off any steam."

* The mathematical formulæ are omitted, as being in some degree unsuited to this Journal.

He then gives formulæ for computing the effects of the slopes and the velocities of bodies of given weight on them, either ascending or descending, and which, by every scientific and practical engineer, ought to be carefully attended to, in the selection and construction of lines of railways.

24. The best way of exhibiting these effects will be by computing the length of equivalent horizontal planes, that is, the lengths of horizontal planes which would be passed over in the same time, and with the same power, as the ascending and descending planes in question, and taking these lengths as the measure of their mechanical effects. For this purpose the following table has been computed, in which the weight of the engine is assumed at 12 tons, of the tender at 6 tons, the load at 82 tons, and consequently the gross weight at 100 tons for goods. In the lighter trains for passengers, 50 tons may be assumed as the gross weight propelled by steam power.

Table of Horizontal Equivalents.

Slopes.	Train 100 Tons.			Train 50 Tons.		
	Equivalent Hor. Lines.		Mean Effect.	Equivalent Hor. Lines.		Mean Effect.
	Ascending.	Descending.		Ascending.	Descending.	
1 in 90	2.74	1.00	1.87	2.21	1.00	1.61
100	2.57	1.00	1.78	2.09	1.00	1.54
120	2.31	1.00	1.65	1.91	1.00	1.45
140	2.12	1.00	1.56	1.78	0.83	1.39
160	2.00	0.83	1.41	1.68	0.83	1.25
180	1.87	0.83	1.35	1.60	0.83	1.21
200	1.78	0.83	1.30	1.54	0.83	1.18
250	1.63	0.83	1.23	1.44	0.83	1.13
300	1.52	0.83	1.17	1.36	0.83	1.09
350	1.46	0.83	1.14	1.31	0.83	1.07
400	1.39	0.83	1.11	1.27	0.83	1.05
500	1.31	0.83	1.07	1.22	0.83	1.03
750	1.21	0.83	1.03	1.15	0.85	1.00
1000	1.16	0.85	1.01	1.11	0.89	1.00
1500	1.10	0.90	1.00	1.07	0.93	1.00

The two cases computed above are nearly a mean of the gross weights of the luggage and passenger trains upon the Liverpool and Manchester Railway.

25. Results of Line A, Article 19.

For a Luggage Train of 100 Tons.

No.	Character.	Measured Distance.	Gradients.	Equivalent Hor. Dist. Forward.	Equivalent Hor. Dist. Backward.	Mean Equiv. Hor. Dist.
1	Level, . .	0.800	0	0.800	0.800	0.800
2	Descent, .	1.530	1 in 2000	1.454	1.606	1.530
3	Ascent, . .	2.950	1 in 1200	3.350	2.550	2.950
4	Level, . .	1.736	0	1.736	1.736	1.736
5	Ascent, . .	6.250	1 in 600	7.938	5.188	6.563
6	Ascent, . .	1.143	1 in 1200	1.298	0.994	1.144
7	Level, . .	1.143	0	1.143	1.143	1.143
8	Descent, .	1.143	1 in 1200	0.994	1.298	1.144
9	Ascent, . .	2.270	1 in 2000	2.367	2.173	2.270
10	Level, . .	0.760	0	0.760	0.760	0.760
11	Descent, .	2.480	1 in 1200	2.157	2.817	2.487
12	Level, . .	0.470	0	0.470	0.470	0.470
13	Ascent, . .	8.455	1 in 800	10.146	7.102	8.675
14	Level, . .	2.600	0	2.600	2.600	2.600
		33.730		37.213	31.237	34.272

Hence 34.272 — 33.730 = 0.542 mile, or about half a mile, the loss from the effects of the gradients.

26. Results of Line B.

No.	Character.	Measured Distance.	Gradients.	Equivalent Hor. Dist. Forward.	Equivalent Hor. Dist. Backward.	Mean Equiv. Hor. Dist.
1	Level, . .	0.875	0	0.875	0.875	0.875
2	Ascent, . .	1.000	1 in 528	1.300	0.830	1.065
3	Level, . .	1.500	0	1.500	1.500	1.500
4	Ascent, . .	2.000	1 in 480	2.652	1.660	2.156
5	Ascent, . .	4.875	1 in 422	6.688	4.046	5.372
6	Ascent, . .	3.625	1 in 440	4.923	3.009	3.965
7	Ascent, . .	6.625	1 in 330	9.831	5.499	7.653
8	Descent, .	4.000	1 in 330	3.320	5.936	4.608
9	Descent, .	2.500	1 in 660	2.075	3.115	2.610
10	Descent, .	1.750	1 in 406	1.453	2.432	1.942
		28.750		34.617	28.902	31.746

Hence 31.746 — 28.750 = 2.996 miles, or very nearly 3 miles lost by the gradients.

27.

Results of Line A,

For a Passenger Train of 50 Tons.

No.	Character.	Measured Distance.	Gradients.	Equivalent Hor. Dist.		Mean Hor. Dist.
				Forward.	Backward.	
1	Level, . .	0.800	0	0.800	0.800	0.800
2	Descent, .	1.530	1 in 2000	1.484	1.576	1.530
3	Ascent, . .	2.950	1 in 1200	3.227	2.673	2.950
4	Level, . .	1.736	0	1.736	1.736	1.736
5	Ascent, . .	6.250	1 in 600	7.450	5.250	6.362
6	Ascent, . .	1.143	1 in 1200	1.251	1.036	1.163
7	Level, . .	1.143	0	1.143	1.143	1.143
8	Descent, .	1.143	1 in 1200	1.036	1.251	1.163
9	Ascent, . .	2.270	1 in 2000	2.483	2.057	2.270
10	Level, . .	0.760	0	0.760	0.760	0.760
11	Descent, .	2.480	1 in 1200	2.247	2.713	2.480
12	Level, . .	0.470	0	0.470	0.470	0.470
13	Ascent, . .	8.455	1 in 800	9.639	7.271	8.455
14	Level, . .	2.600	0	2.600	2.600	2.600
		33.730		36.326	31.336	33.882

Hence 33.882 — 33.730 = 0.152 miles, or about $\frac{1}{7}$th of a mile, the loss upon the gradients.

28.

Results of Line B.

No.	Character.	Measured Distance.	Gradients.	Equivalent Hor. Dist.		Mean Hor. Dist.
				Forward.	Backward.	
1	Level, . .	0.875	0	0.875	0.875	0.875
2	Ascent, . .	1.000	1 in 528	1.212	0.830	1.030
3	Level, . .	1.500	0	1.500	1.500	1.500
4	Ascent, . .	2.000	1 in 480	2.460	1.660	2.060
5	Ascent, . .	4.875	1 in 422	6.138	4.046	5.115
6	Ascent, . .	3.625	1 in 440	4.531	3.009	3.770
7	Ascent, . .	6.625	1 in 330	8.811	5.499	7.155
8	Descent, .	4.000	1 in 330	3.320	5.320	4.320
9	Descent, .	2.500	1 in 660	2.100	2.938	2.675
10	Descent, .	1.759	1 in 406	1.452	2.222	1.837
		28.750		32.399	27.899	30.337

Hence 30.337 — 28.750 = 1.587 miles, or about $1\frac{1}{8}$ miles the loss upon the gradients.

29. On comparing the results of these two lines of A and B, and both with a heavy luggage train of 100 tons, and a light passenger train of 50 tons, which may be taken as a good medium of these two classes, it appears that on the first, A loses about *half a mile*, while B loses about *three* miles of horizontal distance in *steam-power or time*. On the second train, A loses only about *one-seventh* of a mile, while B loses about *a mile and a half* of horizontal distance in steam-power.

30. Again, if the mean horizontal distances be compared, it will be found that in the first train A requires 34.272 miles, while B only requires 31.746 miles. Whence 34.272 — 31.746 = 2.526 miles, or B on the whole gains about double this, or somewhat above 5 miles in one trip forward and back.

Now, on comparing the second train, A has 33.882 miles of mean horizontal distance, while B has only 30.337 miles. Hence 33.882 — 30.337 = 3.545 miles. Therefore B on the whole gains double of this, or about 7 miles in one trip forward and back of steam-power or time.

These conclusions are independent of 5 miles of actual measured distance, for the construction of which additional miles funds must be provided, thus in both cases causing an immense loss to the shareholders of A's line, while that of B is more effective.

31. We shall endeavour to put this loss in the course of *fifty years* in a proper point of view, otherwise to some people the effects would not be sufficiently striking.

The additional 5 miles of railway will, in making, at the rate of L.12,000 per mile, cost L.60,000.

Amount of this in 50 years at 5 per cent.,	L.688,044	0	0
Say 5 miles of steam-power at a halfpenny per ton per mile. Now if there be the transit of 200 tons of goods and passengers daily for 300 days in the year, this will amount to L.625 per annum, which, as an annuity lost, will in 50 years at 5 per cent. amount to	130,842	10	0
Total loss in 50 years, . .	L.818,886	10	0

or above eight hundred thousand pounds,—about as much as would make the railway itself *twice over*.

32. This sum of above L.800,000, is what the shareholders absolutely throw away without any equivalent advantage, through the injudicious selection of the line A, by the caprice of their engineer, or his want of discrimination.

But it is frequently said, let the managers squander as much of the shareholders' money as they please since the public is benefited by it, while time and reflection on their own loss will effectually cure them, and prevent others from following their bad example.

Now, this species of reasoning is completely erroneous, for if any line of railway is unnecessarily extended in length, the public must pay for the superfluous distance caused by its circuitous direction, as is easily shewn.

In the present instance, the line A is more expensive than B in steam, to the amount of two or three miles on the level; and, in addition to this, it is five miles longer, the traffic on which must be paid for at so much per ton per mile.

The expense of traffic on five miles, at 2d. per ton per mile for 200 tons daily, on 300 days in the year, will be L.2500 per annum, which, as an annuity for fifty years at 5 per cent. per annum, will amount to L.523,370. Hence the public must lose in expenses of transit of goods and passengers, upwards of half a million in fifty years. So much for the benefit conferred on the public by injudicious speculators in railways. *In fact, they materially injure the public as well as themselves.*

33. This conclusion shews distinctly what care should be taken in the proper selection of a line of railway, otherwise the most injurious consequences will result to the shareholders. It is inconceivable how many engineers extend the lengths unnecessarily, even where the ground is good, and the slopes very favourable. This can only, in my opinion, be accounted for by a want of proper discrimination in the engineer, and *the erroneous method of estimating the effects of the gradients, by extending the lines one mile for every twenty feet of rise of the summit level, wherever situated,* while, in fact, it should be *one-fifth* of a mile in the case of the heavy train, and *one-eighth* in the light, according to Barlow's table, which makes the allowance rather too great than too little.

34. One error generally leads to another, and in consequence of the first error, that is, estimating 20 feet of rise equal to one mile of distance, the lines are immoderately extended for the

sake of good slopes, thereby losing more, as has been already proved, in distance than is gained by gradients. Hence, too, the policies, as they are called, or fancy grounds, of noblemen and private gentlemen are indiscriminately assailed, who, when great damages for such trespasses are demanded, are branded with the opprobrious epithets of opposers of the public good, are accused of selfishness, and totally destitute of patriotism and a desire to extend the commercial interests of their country!

35. The same fallacious dogma, too, leads these engineers to select lines of railway close along the sea-shore or the banks perhaps of a navigable river, where one-half of the advantages are lost to the interior of the country in the former case, and one-half to the shareholders in the latter, because steam-boats will be able to compete with the railways successfully, both with regard to cheapness and velocity. Hence we see the reason why almost all judiciously chosen railways *traverse the interior of the country*, as may be observed by consulting the map to Colonel Mudge's pamphlet on railways, already quoted.

36. An able pamphlet was published some time ago, entitled, "What will Parliament do with the Railways?" It is there justly observed, as we have also endeavoured to shew above, "That a bad line, if allowed, will not only ultimately prove a failure in itself, but it will operate as a barrier against a better. Let care be taken that public good is not sacrificed to private advantage! It is not enough that a certain number of wealthy and influential individuals have subscribed to the capital, and have put forth the plans for a railway. Nor is it enough that their object may in itself be good; it should be seen whether the same object may be obtained in another way more beneficial to the public, or whether some further or *more enlarged* advantages may not be combined with it. With these views, it will be incumbent on Parliament to watch closely those plans which are not based on broad and extensive principles."

Indeed, it appears to the writer of this article, that no railway should be sanctioned by the Legislature till at least *three lines* be surveyed by eminent engineers, and, when properly examined in the manner the lines we titled A and B have been, then the best, in consideration of all circumstances, should be selected, as has lately been the case with regard to the London and Brighton lines.

The author, in the same pamphlet, points out the propriety of establishing main lines of communication between important places, taking care, at the same time, that those lines have not only reference to particular towns, but to the ultimate benefit of the whole country.

"From these main arteries," says he, "when completed, branches, of course, will hereafter be carried. *It is therefore essential that the great trunks be judiciously selected, that their course be central, and their mechanical character of the best description which the structure of the country will admit.*

"If the great lines be bad, their defects will be felt for ever through the branches communicating with them; and, as before stated, if *once established*, bad as they may be, there will be scarcely a probability of obtaining better, although the nature of the country may obviously supply them."

The public are therefore greatly interested in the proper selection of the cheapest and most economical line of railway in every respect,—ought to make every exertion to obtain it, and by no means to place confidence in any company of railway speculators, who, in general, have no other interest in view than present emolument, by taking especial care, from the early sale of their own shares, to avoid any future responsibility.

For all these reasons combined, it appears to the writer of these remarks, that a *National System of Railways should be adopted*, and that Parliament should exercise great care in examining the nature and qualities of all railways, before passing bills for their completion.

In conclusion, the writer begs leave to remark, that the foregoing observations have proceeded from an honest desire to lay before the public a fair and impartial account of the leading principles which ought to be kept in view in the selection and adoption of proper lines of railway; and though the reasoning has been as much as possible *general*, yet the whole is founded on two real lines of railway which have been both surveyed, and their merits partially canvassed. The preference has been given to the more disadvantageous line A, and against B, both by influence injudiciously employed, and from a report by an engineer, who, from the status it is believed he enjoys, ought to have known the principles which constitute the relative merits of railways better than to extend their lengths one mile for every *twenty feet** of rise in the summit-levels. The more unfavourable line A has now received the sanction of the Legislature; and should it ever be completed, the public in general, and the shareholders in particular, will find to their cost, that the preceding estimate of its merits are on the whole perfectly well founded.

* In fact, *one hundred and twenty feet*, with the usual gradients, would have been nearer the truth, so far as the expense of steam-power is involved, though this, of course, does not include the expenses of formation.

ON THE DISEASES INCIDENT TO THE MOST USUALLY CULTIVATED PLANTS. NO. II.

By George W. Johnson, Esq., Corresponding Member of the Maryland Horticultural Society, &c.

The Ambury, Anbury, Hanbury,* or *Club-Root.*—The deficiency of knowledge relative to the diseases of plants is well illustrated by the imperfect and inaccurate observations that have been adventured upon this disease. Where there is much difference of opinion there is little real knowledge, and both these are certainly the case in the instance before us. Some cultivators assert that the disease arises from a variableness and unfavourable state of the seasons; a second party of theorists advance, that it is caused by insects; and a third, that it is owing to a too frequent growth of the same crop upon the same site. Every man having formed an opinion, usually clings to it pertinaciously, and sets its estimate far above its real value, or correctness.

> " 'Tis with our opinions as our watches; none
> Go just alike, yet each believes his own."

The chief error appears to be in considering any of the above enumerated clauses as the *exclusive* one, for, beyond doubt, they each contribute, either immediately or remotely, to induce or exasperate the attacks of the ambury.

I am about, in the first place, to consider the disease exclusively as affecting the cabbage, and, secondly, as it operates upon the turnip, though other species of brassica, the hollyhock, &c. are subject to its attacks. Its progress has invariably appeared to me as follows:

Cabbage plants are frequently infected with ambury in the

* This, the correct name, is evidently derived from the Saxon word *Ambre*, a wart suffused with blood, to which horses are subject. In Holderness, a district of Yorkshire, this disease is known as "*Fingers and Toes,*" from its causing the tap-root of the turnip to be divided into swollen fibres, resembling those members of the human body. On this, Mr Spence, the entomologist, wrote a very sensible pamphlet, entitled "Observations on the Diseases in Turnips termed in Holderness 'Fingers and Toes;' Hull, 1812."

seed-bed, and this incipient infection appears in the form of a gall or wart upon the stem, immediately in the vicinity of the roots. If this wart is opened, it will be found to contain a small white maggot, the larva of a little insect called the weevil. If, the gall and its tenant being removed, the plant is placed again in the earth, where it is to remain, unless it is again attacked, the wound usually heals, and the growth is little retarded. On the other hand, if the gall is left undisturbed, the maggot continues to feed upon the alburnum, or young woody part of the stem, until the period arrives for its passing into the other insect form, previously to which it gnaws its way out through the exterior bark. The disease is now almost beyond the power of remedies. The gall, increased in size, encircles the whole stem ; the alburnum being so extensively destroyed, prevents the sap ascending; consequently, in dry weather, sufficient moisture is not supplied from the roots, to counterbalance the transpiration of the leases, and the diseased plant is very discernible among its healthy companions, by its pallid hue, and flagging foliage. The disease now makes rapid progress; the swelling continues to increase, for the vessels of the alburnum and the bark continue to afford their juices faster than they can be conveyed away ; moisture and air are admitted to the interior of the excrescence through the perforation made by the maggot; the wounded vessels ulcerate; putrefaction supervenes, and death concludes the stinted existence of the miserable plant. The tumour usually attains the size of a large hen's egg ; has a rugged, ichorous, and even mouldy surface, smelling strong and offensively. The fibrous roots, besides being generally thickened, are distorted and monstrous from swellings, which appear throughout their length ; which apparently arise from an effort of nature to form receptacles for the sap, deprived as it is of its natural spissation in the leaves. These swellings do not seem to arise immediately from the attacks of the weevil; for I have never observed them containing its larva.

Mr Marshall, very correctly, describes the form which this disease assumes when it attacks the turnip. It is a large excrescence appearing below the bulb; growing to the size of both hands, and, as soon as the hard weather sets in, or it is, by its own nature, brought to maturity, becoming putrid, and

smelling very offensively. On the last day of August, when the bulbs of the turnips were about the size of walnuts in the husk, the amburies were as big as a goose's egg. These were irregular and uncouth in their form, with inferior excrescences, resembling the races of ginger hanging to them. On cutting them, their general appearance is that of a hard turnip, but on examining them through a magnifier, there are veins, or string-like vessels, dispersed among the pulp. The smell and taste somewhat resemble those of turnips, but without their mildness, having an austere and somewhat disagreeable flavour, resembling that of an old stringy turnip. The tops of those much affected turn yellow, and flag with the heat of the sun, so that, in the day-time, they are obviously distinguishable from those which are healthy. These distortions manifest themselves very early in the turnip's growth, even before the rough leaf is much developed. Observation seems to have ascertained, that if the bulbs have attained the size of a walnut unaffected, they do not subsequently become diseased.

Mr Spence has clearly shewn from established facts, that the ambury does not arise from any imperfection of the seed sown; for experience demonstrates, that, in the same field and crop, the attacks are very partial; and crops in two adjoining fields, sown with seed from the same growth, will one be diseased and the other healthy.

2dly, It does not arise from an unfavourable time of sowing, or from dry unpropitious seasons during their after-growth, "for, on this supposition, we might expect that in *all* turnip-districts the disease would occasionally make its appearance, in consequence of variations in the period and mode of sowing, or from following droughts; yet we know that, in many parts of the country, it has never been heard of."

3dly, It does not arise from the quality of the soil, for Sir Joseph Banks suffered from its infecting thin-stapled, sandy fields, whilst all Holderness, which is generally a strong loamy soil, was found equally liable to the disease. But a still more decisive evidence on this point is, that it makes its appearance at uncertain intervals upon the same soil; the turnips upon it being in some years greatly injured by the disease, and in other years entirely free.

4thly, Although it is certain, from the observations of Sir Joseph Banks, and general experience, that the disease occurs most frequently in soils *tired* of the crop, that is, soils upon which it has been grown for a long course of years; yet, that this is not the immediate cause of the disease, is proved by the fact, that often only patches in the same field are affected, and the same observers record, that it appears in soils that have not produced turnips for a long series of years. The diseased specimens examined by Mr Marshall were from an old orchard that had not borne turnips within the memory of man.

Mr Spence concluded, that the disease is occasioned by the poisonous wound inflicted by some unascertained insect upon the turnip, in an early stage of vegetation, or by its insinuating its egg into it, infusing at the same time a liquid, causing a morbid action in the sap-vessels, and the consequent forming of excrescences. This correct opinion was afterwards confirmed by the actual discovery of the insect; and that there actually is a maggot generated from the egg, of which fact he was at the time ignorant.

The maggot found in the turnip ambury, is the larva of a weevil called *Curculio pleurostigma* by Marsham, and *Rhynchænus sulcicollis* by Gyllenhal. "I have bred this species of weevil," says Mr Kirby, "from the knob-like galls on turnips, called the Ambury, and I have little doubt that the same insects, or a species allied to them, cause the clubbing of the roots of cabbages."

Marsham describes the parent as a coleopterous insect, of a dusky black colour, with the breast spotted with white, and the length of the body one line and two-thirds.†

* Kirby and Spence's Introduction to Entomology, i. 450.

† He adds, Subtus albido squamosus; inter thoracem et elytrorum basin puncto albo pectus notatur. Thorax utrinque obsoletè dentatus, posticè et anticè fossulâ intermediâ exaratur. Femora omnia denticulata.—Entomologia Brit. 282. A very full description of this insect is in the "Insecta Svecica Descripta" of Gyllenhal, vol. iii. p. 229, under the name of *Rhynchænus sulcicollis*. It is the *Curculio affinis* of Panzer's Faunæ Insectorum Germanicæ initia; the *Curculio sulcicollis* in Paykull's Fauna Svecica; the *Falciger sulcicollis* of Dejean's Catalogue des Coleoptères; and the *Cryptorhynchus alauda* of Germar's Insectorum species novæ, &c.

The general experience of all the farmers and gardeners with whom I have conversed upon the subject, testifies that the ambury of the turnip and cabbage usually attacks these crops when grown for successive years on the same soil. This is precisely what might be expected; for the parent insect always deposits her eggs in those situations where her progeny will find their appropriate food; and in the fragments of the roots, &c. of preceding crops, some of these embryo ravagers are to be expected. That they never attack the plants upon a fresh site is not asserted. Mr Marshall's statement is evidence to the contrary; but it is advanced that the obnoxious weevil is most frequently to be observed in soils where the turnip, or cabbage, has recently and repeatedly been cultivated.

Another general result of experience is, that the ambury is most frequently observed in dry seasons. This is also what might be anticipated, for insects that inhabit the earth, just beneath its surface, are always restricted and checked in their movements by its abounding in moisture. Moreover, the plants actually affected by the ambury, are more able to contend against the injury inflicted by the larva of the weevil by the same copious supply. The development of their parts, their growth, is more rapid; consequently the maggot has not to extend his ravages so extensively in search of food as in drier seasons, when the stem is less juicy, and of smaller growth. In wet periods, also, the affected plants shew less the extent of the injury they have sustained; for their foliage does not flag, because their transpirations of watery particles is less, and their supply of nutriment from the soil is more free. In wet seasons I have in a very few instances known an infected cabbage plant produce fresh healthy roots above the swelling of the ambury.

These facts being premised, better qualify us for the consideration of the best modes of preventing the occurrence of the disease, and of palliating its attacks. It is apparent that any addition to the soil that renders it disagreeable to the weevil, will prevent the visits of this insect. The gardener has this in his power with but little difficulty, for he can keep the vicinity of his cabbage, cauliflower, and brocoli plants soaked with water.

Mr Smith, gardener to M. Bell, Esq. of Woolsington, in

Northumberland, expresses his conviction, after several years' experience, that charcoal-dust spread about half an inch deep upon the surface, and just mixed with it by the point of a spade, effectually prevents the occurrence of this disease.* That this would be the case we might have surmised from analogy, for charcoal-dust is offensive to many insects; and is one of the most powerful preventives of putrefaction known. Soot, I have reason to believe, from a slight experience, is as effectual as charcoal-dust. Judging from theoretical reasons, we might conclude that it would be more specifical, for in addition to its being, like charcoal, finely divided carbon, it contains sulphur, to which insects also have an antipathy.

Mr Drurey, a practical farmer at Erpingham in Norfolk, considered marl a certain preventive of this disease. He, and several other judicious farmers, also thought that *teathing*, that is, giving sheep and cattle their green food, turnips, &c. upon the barley-stubbles intended for turnips as the succeeding crop, will cause the ambury.† It is very evident that it would mix fragments with the soil that would be liable to contain the eggs of the weevil. The marl approved by Mr Drurey is probably the calcareous marl which occurs at Thorp Market, in the hundred of North Erpingham; but as there is a slight doubt, owing to the deficiency of accuracy in the statement, it affords me an opportunity to impress upon agriculturists, in general, the great importance of employing more certain terms than they usually do. What can be more indefinite than the statement, that marl is a certain preventive of the ambury? for the very first question suggested to the reader's mind is, What marl is intended? Is it a chalky-marl or a clay-marl? Is it a mixture of chalk and clay, or of chalk and siliceous sand? for all these varieties of marl are known to agriculturists. The want of a correct nomenclature is one of the drawbacks and deficiencies checking the improving progress of agriculture. Few farmers ever thought upon this point, and still smaller is the number who duly appreciated its importance. Yet it is an incontrovertible fact, that no art, or science, can advance rapidly, until its

* Trans. of London Horticultural Soc. vi. art. 2.

† Marshall's Rural Economy of Norfolk, ii. 33–35.

technical terms are fixed, terse, expressive, and generally understood. Chemistry attained a greater aid to its advancement by the introduction of its new nomenclature by Lavoisier, than by any series of discoveries that have since been made on its rapid and brilliant progress. If a sulphate, an acid, or a metal is mentioned, a chemist immediately has a definite idea of the nature and properties of the substance alluded to; but if a *loam* or *marl* is spoken of, would any two farmers agree in their idea of what description of earthy compound was intended? To make it well understood, a long detail must be added, and nothing checks the imparting of knowledge more, than the person capable of imparting it being conscious that he must define every term as he goes on, and that even then it is doubtful if he shall succeed in making himself intelligible. The very name (ambury) usually applied to the disease which is the subject of this paper, is another proof of the necessity of a reformed agricultural nomenclature; for, in Suffolk, the same title is given to another disease, which merely affects the leaves of the turnip.

Sir Joseph Banks, Mr Baker of Norfolk, and others, agree that marl is the best preventive of ambury, and another evidence of the efficacy of applications to the soil is afforded by a gentleman in Holderness, a Mr Brigham, who had a highly manured clayey ridge, which he had levelled the year before, and this grew turnips entirely free of the disease, whilst, in the natural rich loam of the field, they were much infected.

Francis Constable, Esq. of Burton Constable, had a field that had been in grass twenty years: this he pared, burned, and sowed with turnips, obtaining a crop perfectly free from the disease. Two white crops were then taken, after which turnips were again sown; a considerable portion of the crop was then infected with the disease.*

I have, myself, tried the efficacy of common salt in preventing the occurrence of this disease. Its tendency to keep the soil moist, and to irritate the animal-frame, certainly checks the inroads of the weevil, and its generally beneficial effects as a manure enables the plants better to sustain themselves under the weakening influence of the disease; but it is not a decisive pre-

* Spence's Observations on the Diseases in Turnips termed in Holderness "Fingers and Toes."

ventive. The following result of one of my experiments was read to the Horticultural Society of London, October 16. 1821.

"Some cauliflowers were planted upon a light siliceous soil, which had previously been manured with well putrefied stable manure, and over one-third of the allotted space was sown salt, at the rate of twenty bushels per acre, immediately before the planting, in the beginning of July 1821; the previous crop had been brocoli; fifty-four plants were set on the two-thirds unsalted, and twenty-six on the one-third salted; the result has been, that of the fifty-four unsalted, fifteen have been diseased and unproductive, but of the twenty-six salted, only two.

"Some more cauliflowers were planted on a plot of ground which had previously borne a crop of savoys, and half of which ground had been sown with salt four months previous to planting; in this, the unsalted and salted were alike nearly destroyed, evincing that the salt was not present in a sufficient proportion to produce the desired effect.

"With regard to the use of salt as a *cure* for the disease, I am inclined to think, from the results of experiments which I have instituted, that unless the salt be applied very early, it would be useless, for the root soon becomes so diseased as to be entirely past recovery."*

I have a strong opinion that a slight dressing of the surface-soil, with a little of the dry hydro-sulphate of lime, that may now be obtained so readily from the gas-works introduced throughout England, would prevent the occurrence of the disease, by driving the weevils from the soil. It would probably as effectually banish the turnip-fly or flea, if sprinkled over the surface immediately after the seed is sown. I entertain this opinion of its efficacy in preventing the occurrence of the ambury, from an instance when it was applied to some brocoli,—ignorantly grown upon a bed where cabbages had as ignorantly been endeavoured to be produced in successive crops These had invariably failed from the occurrence of the ambury; but the brocoli was uninfected. The only cause for this escape that I could trace, was, that just previously to planting, a little of the hydro-sulphuret of lime had been dug in. This is a very fetid, powerful compound. Where dry lime purifiers are employed at gas-works, it may be obtained in the state of a dry powder; but where a liquid mixture of lime and water is employed, the hydro-sulphuret can only be had in the form of a thick cream. Of the dry hydro-sulphuret I would recommend eight bushels per acre to be spread regularly by hand upon the surface, after the turnip-seed is sown, and before harrowing. If

* C. W. Johnson's Essay on Salt, p. 136.

the liquid is employed, I would recommend 30 gallons of it to be mixed with a sufficient quantity of earth or ashes, to enable it to be spread over an acre in a similar manner.

For cabbages, 12 bushels, or 45 gallons per acre, would not, probably, be too much spread upon the surface, and turned in with the spade, or last ploughing. To effect the banishment of the turnip-flea, I should like a trial to be made of 6 or 8 bushels of the dry, or from 22 to 28 gallons of the liquid hydro-sulphuret being spread over the surface immediately after the sowing, harrowing, and rolling are finished. Although I specify these quantities as those I calculate most correct, yet, in all experiments, it is best to try various proportions. Three or four bushels may be found sufficient; perhaps 12, or even 20, may not be too much.

Frequent hoeing has been recommended as a preventive of this disease, but I believe this to be unsustained by either reason or practice. Hoeing, like any other stirring of the surface soil, assists the ready admission of the atmosphere to the roots of the incumbent plants, and so far promotes their general health; but I have never yet found, or even heard, any one advance that a frequently hoed part of a crop was free from the ambury, which affected the more rarely hoed portion.

It would be fortunate if our white turnip crops could be sown as early as our Swedes; for they would then probably be as little liable to the ambury as these are. The reason of this seems to be, that the weevil does not emerge into that state in which it is capable of injuring the young plants until the summer is far advanced, and by that time the Swedish turnips have attained a size which secures their safety. I conclude this to be the case from my own slight, very slight observations upon the habits of the insect, for, unfortunately, we are very deficient in knowledge upon this point. It is to be regretted, that entomologists are not more attentive to what may be termed the private and particular history of the subjects of their study. To define and describe their specific characters is very useful, but it is chiefly so, because it is like a good index to an intricate volume. It is of far more utility to ascertain their habits, and their periods of gestation and transformation, because this knowledge is

that which often affords us one of the best means of avoidin their ravages.

In cabbages, the ambury may usually be avoided by frequen transplantings, for this enables the workman to remove the ex crescences upon their first appearance, and renders the plant altogether more robust and ligneous; the plant, in its tende sappy stage of growth, being most open to the insects' at tacks.

The sap of the turnip and cabbage thus diseased, undergoe a considerable change. Its specific gravity is much increased arising from an excess of the mucilage, vegetable extract, an saline constituents, which it naturally contains, caused probabl by its being in a concentrated state; for it is very considerabl reduced in quantity, compared with what the same plant con tains when healthy. The increase of the saline components un questionably exasperates the disease. They consist chiefly o chloride and carbonate of potass, which, by the corroding powe of the last-named, and the irritating qualities of both, must in crease the sanious discharge by stimulating the already-lacerate and morbidly-sensitive vessels. Probably the occasional appli cation of diluted acids, such as the dregs of beer, would miti gate the symptoms, and check the progress of the ulceration but the application could not be expected to effect a cure, nor i it available, even if proved to be a specific.

The warts or galls that so frequently may be noticed on th *bulbs* of turnips, must not be mistaken for the ambury in a miti gated form. If these are opened, they will usually be found t contain a yellowish maggot, the larva, probably, of some specie of cynips. This insect deposits its eggs in the turnip when o larger growth than that when it is attacked by the weevil, an the vegetable, consequently, suffers less from the injury; but from some slight observations, I am inclined to conclude, tha the turnips thus infested suffer most from the frosts of winte and are the earliest in decay. This is what might be anticipat ed, for when the maggot has escaped from its cell, the hollow c this admits the exterior air to the wounded vessels, and forms reservoir for moisture, agents which promote the progress of pu trefaction, and assist the penetrating influence of the freezin temperature.

THOUGHTS ON DRAINING AS A PROFITABLE OUTLAY OF CAPITAL.

In expressing these "thoughts" on draining, our sole object has been, to recommend to all landholders, in the strongest manner, not merely draining, which may be accomplished in the usual manner, by putting a drain here and there in the most apparently damp portions of a field, but *thorough* draining, which will most effectually render every portion of a field, whether apparently damp or no, so dry, as that they may be worked in the most untoward circumstances of weather, the soil derive the entire benefits of the manure, and vegetation proceed in an almost uniform progress to maturity in a comparatively short period of time. Thorough draining can alone attain these objects; because, as extensive experience in draining has convinced us, and still more extensive observation of the practice of others has corroborated that conviction, the vast proportion of the arable soil of this country rests on a clayey and therefore retentive subsoil, the rain falling on which percolating through the arable soil remains stagnant, and this stagnant water does much greater injury to the arable soil and its products, than the water from any number of springs that are found to pervade land. This being the physical condition of the arable soil in general, it is clear, that that kind of draining which will most easily relieve stagnant water, will affect greater good to it than any other; and that kind can be no other than thorough draining. There are, perhaps, various ways of performing this operation; but the very obvious one of running a drain up each furrow, suggests itself as that which affords the most numerous outlets to the stagnant water. We presume there cannot be a difference in opinion regarding this obvious fact, whatever difference there may be in the practice of drainers. In farming, practice does not always consecutively follow opinion; because differences in practice are entirely guided by differences in expense, that is, present outlay. The present outlay will, no doubt, be less in the case where a drain is run up every alternate furrow, than in that up every furrow,—a plan recommended by some drainers in order to mitigate present outlay; and should the nature of the subsoil

admit of this distance for its *thorough* draining, it is quite sufficient, and a greater outlay in such a case would of course be only a waste of money. But no greater error can be committed by a drainer than to run a drain up every other furrow, with the view of saving present expenses, and with the intention of completing the draining by running a drain up every furrow at some future period; because the intermediate undrained space or ridge, resting on retentive subsoil, will derive as little benefit by only draining the alternate furrow, as if no draining had been effected at all, and all the manure, lime, and labour expended upon it in the mean time will have been thrown away. Far better drain the half or any portion of the field effectually, than go over the whole in such a superficial, and in the end it will be found to be an unsatisfactory, manner.

But an apprehension may reasonably arise on the quality of the soil thus thoroughly drained repaying the outlay of capital. If the soil is of that inferior nature as to justify such an apprehension, it is an easy matter to restrict the experiment, and to drain a small portion of it, and subject it to a rotation of cropping, and observe the result. A small experiment cannot require much outlay, and at most the loss cannot be great, should the result be unfavourable; but should it succeed, of which there is the greatest probability, a safe guarantee will have been given for future extended success. The experiments also of others should stimulate to imitation, and will allay apprehension. As a means of allaying apprehension on this head, we shall enumerate the favourable results of some experiments of the kind which have come to our knowledge through the liberality and kindness of the experimenters themselves.

The result we shall first notice is derived from the experience of Mr North Dalrymple, of Campie, near Musselburgh; and in reference to the improvements on his estate of Cleland, in Lanarkshire, he thus expresses himself in respect to thorough-draining:—

"I am clearly of your opinion," he says, "that well authenticated facts on economical draining, accompanied with details of the expenses, value of succeeding crops, and of the land before and after draining, will be the means of stimulating both landlords and tenants to pursue the most important, judicious, and *remunerating* of all land improvements. The statements below will prove the advantages of furrow-draining; and as to the *profits* to be derived

from it, they are *great*, and a farmer has only to drain a five-acre field to have ocular proof upon the point."

No statements can be more satisfactory in themselves, and more encouraging to drainers than the following. They will be best given in Mr Dalrymple's own words.

"1832. No. 1. Easter, Ladywell, and Whinny fields, containing 54 acres, cost L. 303, 7s. for draining; average, say L.5, 12s. per acre. These fields were *not* furrow-drained, but cross-drained, and are *not dry enough*. The wheat sold for L.11 an acre in the Easter field. The turnips in the Ladywell field at L.25, 13s. 4d. The drains were all built and covered with small stones, which were obtained quite at hand. The land was formerly completely covered with rushes. Soil, stiff (provincial *chattery*) clay, and used to let in pasture at 20s. an acre. Last summer (1836) the Easter field fed five cheviot ewes and lambs upon an acre.

"1833. No. 2. Horselees and Jennyside fields, 18 acres, cost for draining L.98, 7s.; say average, L.5, 9s. per acre. These fields were furrow-drained, 18 feet between each drain, 30 inches in depth, cut with the common and narrow spades, and filled eighteen inches with slag (scoriæ) from an iron furnace contiguous. All the mouths of the furrow-drains terminated in main drains 36 inches in depth, laid with tiles and soles. The fields are *now perfectly dry*. There was a very fine crop of wheat (about 8 acres) which sold for more than L.13 an acre. The potatoes brought 15 guineas, and the turnips L.21. The land was formerly occupied with whins and rushes, and let for 12s. an acre. When let for pasture, I expect to get 50s. an acre for the land.

"1836, No. 3, Longbog, 9 acres. Cost for draining L.69, say average, L.7, 13s. per acre. This field was furrow-drained 16 feet between each drain, 30 inches in depth, and cut as in No. 2. The field *is dry*, and bore a good crop of oats. The land was previously drowned with water, and covered with rushes, and brought about 25s. an acre for grazing. A large portion of this field was very stiff clay; but now (February 1837) that it has been twice ploughed, the soil is quite changed both in substance and colour. The reason why this field cost so much more for draining than No. 2 was, that it was drained in very wet weather, when the land became so poached with carting, that I was nearly beaten with it."

Another testimony is Mr James Howden of Wintonhill, near Tranent, and although his is not so satisfactory as the foregoing, inasmuch as it does not exhibit so many particulars of expense and produce, still it is an encouraging statement for tenants, in regard to the outlay of money in thorough-draining. In corroboration of sentiments which we have often expressed, Mr Howden says,

"I have practised the system of furrow-draining to a considerable extent, and am fully satisfied that it is one of the greatest improvements ever intro-

duced into our agriculture. It is not easy to say, with certainty, as to the exact increase of produce which may be derived from it, so much depending on the nature of the soil and the seasons. The farm which I at present occupy consists mostly of a clay-soil, resting in general upon a retentive subsoil, and, consequently, was much injured from the retention of rain-water, and, in some places, from water springing from below. The method I am adopting for laying it dry is, where the subsoil is very retentive, to put a two-feet drain into each furrow, the breadth of the ridges being 18 feet. Where the subsoil has a tendency to draw under-water, I lay two such ridges together, and put a drain in each furrow, the depth of which is regulated by the nature of the subsoil; but in general they are 2½ feet in depth. There being but few stones on my farm, I use tiles; which I find to answer uncommonly well; indeed, I would prefer them to stones, even admitting that I had them upon my farm, for these reasons:—Drains are cut in winter, and in most seasons, and particularly the present, it is almost impossible to get stones brought forward to the drains, and to induce women to fill them; besides, the injury which the land sustains by poaching with carts is considerable. Where land has a good declivity, stones, when well broken, will admit the water for a considerable time; but when land is nearly flat, tiles have a decided advantage for durability of drain. In covering in the tiles, I either put in some brushwood or mix a little of good earth with the subsoil, in order to allow the absorbed water to sink more freely into the drain. I am aware that some people have a prejudice against tiles, and allege, that in a few years the earth above them will consolidate so much as to become impervious to water. I can only say, that I have used them for twelve years, and find the water making its way by them as freely as when the drains were first executed. With regard to the expense of draining a Scotch acre with tile-drains at 18 feet asunder, and 2 feet in depth, it will cost for cutting and filling 3½d. per rood of 18½ feet, or L.2, 6s. per acre. Prime cost of tiles is 40s. per thousand.* Being seven miles distant from the kiln, I must add 8d. per thousand for carriage. Say that 2700 tiles are required, their cost will be L.6 : 9 : 6, making the total expense of draining L.8 : 15 : 6 per acre. The expense no doubt is great, still I am of the belief, that upon all damp heavy lands furrow-draining will repay, on an average, from 15 to 20 per cent on the outlay."

Here we have the encouraging testimonies of both a landlord and a tenant, as to the remunerating returns derived from thorough-draining. Many similar results, we have no doubt, have been experienced by many drainers, had we been so fortunate as to have ascertained them. Abundant testimony on this subject would be very desirable; for in such a case, "in the multitude of counsellors, there is safety." We regret, however, to find that improvers, especially tenants, are averse to disclose the favourable results of their improvements, in the belief, we pre-

* This price is much too high.—Editor.

sume, that such disclosures might reach the ears of their landlords, and ultimately militate against their interests when their leases are to be renewed, by raising the value of their farms. Such a motive for silence on this subject springs from an error of judgment, for it is impossible for any improver of the soil to conceal his operations from public view, and although every spectator may be unable to ascertain the exact cost of all the particulars of the improvements which he sees carrying on, yet it is impossible to prevent any proprietor or his substitute from judging of the increased value of the land improved, and exacting a proportionably higher rent on a new lease. The attempt, if made, would prove fruitless. But there is inconsistency in tenants in attempting concealment of the advantages of improvement, on the ground of rents being raised, for they never hesitate on imposing increased rents on themselves by prosecuting improvements, to the extent of six or eight shillings an acre, or even more, if they conceive the improvements will repay the outlay during the currency of their leases, and yet few landlords are disposed to demand such an increase of rent on a renewal of lease, as the favourable results of the outlays of their tenants might justify; few of them we believe are disposed to ride the willing horse to death. Besides, tenants who are disposed to expend large sums on improving their landlord's properties, know that the rent forms but the smaller portion of their annual obligations, and of course any fair addition to it will bear but a small proportion to the advantages derived from the improvements which have enabled them to raise a large increased produce from their farms, with the usual amount of labour. But apart from any other consideration, there is selfishness in desiring to conceal advantages, when derived from improvements conducted on any applicable principle, from their brethren who are placed in similar circumstances. On the contrary, it is wise policy on the part of all tenants, and particularly on those who apprehend an undue increase of rent, for none can complain of its fair increase, to divulge the results of their improvements, whatever they may be; because, should they be favourable, and effected under selfish and avaricious landlords, the more widely will their principles be promulgated, their system of improvement extended, and the conduct of the more generally generous land-

lords will of course render that of the selfish, by contrast, more amenable to public opinion. Fortunately, however, for the encouragement of industrious and improving tenants, landlords now-a-days know their own interests better, than to take improper advantage of the improvers of their own properties. Indeed, we know it to be the practice of some of them to discharge the expenses of cutting and tiles, and charge the tenants with 5 per cent. on the outlay, a very equitable arrangement, and one equivalent to a loan of capital to the tenant.

These remarks might fitly terminate the thoughts on draining as a profitable outlay of capital; but there are some considerations of a practical nature connected with thorough-draining, which yet deserve attention. Some farmers are puzzled about the draining of flat fields. There are very few fields that are perfectly flat, but there are none that the spirit-level cannot give ample information of. A fall of one foot in three hundred, with a tile and sole opening, is quite sufficient for the flow of water. In order to increase the fall, the drains may be cut a little deeper towards the lower ends. These expedients will secure egress to the water out of the drains; but the fall on every ridge, from its crown to the bottom of the drain in each furrow, is of itself quite sufficient for the drainage of the ridges.

The ameliorating effects of thorough-draining should not be expected to develop themselves at once. A little time is requisite to get quit of the water with which the soil above the level of the bottoms of the drains are surcharged, besides the absorption of the fresh rain that may have fallen on the land in the mean time.

Much unnecessary fear is expressed about bringing the *till* to the surface. If much cold wet clay, in proportion to the soil, is brought up at once immediately after draining, and mixed with the soil with only one ploughing, the probability is, that the succeeding crop of corn will not be much worth; but if a little of it is brought up before winter, and subjected to the influence of rain, frost and air, manured and intimately mixed with the surface soil, the succeeding crop itself will most probably repay the expense of draining. For a corn crop, however, to succeed well after thorough-draining, the drains should be formed in autumn or winter on lea which is to be ploughed in spring

in the ordinary way, without bringing up any of the clayey subsoil. Should it be desired to expose any of the subsoil, it is best ploughed up with the stubble when drained before winter, and the first crop should either be potatoes or turnips, perhaps always the latter, in order to afford more time for the working and exposure of the land.

There is no urgent haste for breaking up the *pan* or band of the clayey subsoil immediately after thorough draining. With a little patience the desiccating power of the draining will effect much for the drainer in that way. The pan is generally composed of a portion of clay indurated with an oxide of iron. So long as water is supplied before draining in a stagnant state to the ferruginous substance, the oxidation progresses and accumulates. When the source of oxidation, on the other hand, is removed by draining, the pan loses its induration, moulders into a loose earth, and the iron in it forms new combinations with acids in the form of salts, which, on dissolution, either assist vegetation, or neutralise the injurious properties of other obnoxious ingredients in the soil. A deep ploughing after this change has been effected, will accomplish more for rendering the soil a fit pabulum for plants, than any previous deep or subsoil ploughing.

Nor should lime be too hastily laid on land after being thorough-drained. The more intimately lime is mixed in or with the soil, the greater are its benefits. It cannot be intimately mixed with the soil until the latter is properly pulverized; and the soil can only be properly pulverised, after having been in the first instance well worked. These are progressive operations and require time. Lime can only thus be judiciously applied to the soil when in preparation for the fallow-crop. As to the time for its application, there will hardly be time before the planting of potatoes, and we believe it has been found to bestow no immediate advantage on turnips, so that it may be applied immediately after the removal of the potato in autumn or the turnip crop in spring. It can be most equally spread on the ground pattered by sheep when fed on turnips, and ploughed in immediately after with a light cross-furrow; and the subsequent seed-furrow in the direction of the ridges will most effectually mix the soil and it together; or it can be spread after the cross-furrow and immediately harrowed in. This latter plan, though not so easy for carting, or perfect for spreading, is never-

theless the safest for preserving the lime, for should rain or wind ensue after the lime has been spread upon the pattered land, it might become affected by the rain or blown about by the wind, before it be covered by the plough-furrow. The succeeding crop of barley will derive immediate benefit from the lime, in strengthening the straw and giving it a bright colour, and in hardening the grain and rendering it more fit for malting.

We conceive we cannot present a greater inducement, or afford a greater encouragement, to the farmer for prosecuting any operation by a reference to stronger facts than those we have at present offered for the prosecution of thorough-draining. Let him therefore commence it, if he have not already done so, with vigour, pursue it with confidence, and he will assuredly long reap the fruits of it with profit.

ON THE PROPAGATION OF THE APPLE-TREE.

In the number of this Journal for September 1837, I observe the following statement, among the Miscellaneous Notices:—

"*Propagation of Apple Trees.*—A new plan for increasing plantations of apple-trees has lately been carried into extensive practice by the horticulturists of Bohemia. Neither seed nor grafting is required. The process is to take shoots from the choicest sorts, insert them in potatoes, and plunge both into the ground, leaving but an inch or two of the shoot above the surface. The potato nourishes the shoot, while it pushes out roots, and the shoot gradually grows up and becomes a beautiful tree bearing the best fruit, without requiring to be grafted. Whatever may be the success of the undertaking, its novelty at least is an inducement to give it a fair trial."

I beg leave to remark that six or eight years ago a similar statement was published. It was not then represented as a general practice, but merely as the successful operation of an individual in Bohemia. In consequence of the publication, I immediately made the experiment. I took cuttings of various apple-trees, and inserted each cutting in a potato, and planted the potato and cutting, leaving only an inch or two of the shoot above the surface. The consequence was that *the potatoes did grow*, but the *apple-tree cuttings did not grow*. It then occurred to my gardener, James Smith, who had long been employed as a nurseryman, that we should have sliced off the eyes of the potatoes. Next year this was done and the experiments repeated, but the potatoes still grew, but not the apple cuttings. The experi-

ments were tried, not only in the country but also in the back ground of a house in the New Town of Edinburgh, but in no instance with success.

It has since occurred to me that to complete the experiment we ought to have *boiled* the potatoes, but this was not done and had not been suggested by the publication which mentioned the practice. In the meanwhile, so far as *raw* potatoes are concerned, my opinion necessarily is, that the plan of rearing orchards by cuttings inserted in potatoes may, for aught I know, succeed in Bohemia, but it wont do for Scotland. I do not recollect whether we made a trial with turnips instead of potatoes, although I remember we at one time talked of trying turnips. Most people are no doubt aware that there is a species of apple-tree which can be reared from cuttings, like a willow or a poplar, and produces sweet apples without engrafting. I have two of these trees in bearing. I got the cuttings from Mr John Geddes of the Verreville Works, Glasgow. They were taken from a tree that had been removed from the College garden, and that tree was said to have been propagated from a tree belonging to the Monastery of Aberbrothock.* The apples are rather small, round, and may be eaten from the tree, being quite sweet.

In the mean while the intelligence from Bohemia suggests this remark, that, although the community are greatly indebted to those who bring home intelligence of new and valuable improvements in any art, yet a traveller ought to be aware that it is not enough to mention a foreign practice in general terms. By doing so he merely gives rise to disappointing experiments and a distrust of all such communications. To bring home an improvement beneficially, the traveller ought to endeavour to become acquainted with the minute steps of the process adopted by the foreigners. In this case, for example, the season of planting should have been mentioned, the kind of cuttings, if of last year's growth *only*, or with the addition of part of a former year's growth, also if the potato had been subjected to any preparatory operation, if potatoes of a special sort are used, if the ground is prepared in any particular manner, &c.

F.

* The Arbroath Oslin or Original Apple, here alluded to, is a well known variety. It may be added, that all the burr-knot and codlin tribes of apple-trees grow freely from cuttings.—Edit.

ON FATTENING CATTLE ON DIFFERENT KINDS OF FOOD.*

By Mr John Brodie, Amisfield Mains, Haddington.

Agreeably to the conditions, the Committee of Management, immediately after I had intimated my intention of competing, appointed an efficient Sub-committee to assist me in dividing a lot of twenty Aberdeenshire polled cattle, into four lots of five each, and also to superintend and report upon the manner in which the experiments were conducted.

The cattle were bought at Falkirk on the 12th of October, and on the 24th were lotted, and put into separate yards, each of which had ample space, and shelter from the weather, by covered sheds, for the several lots which were distributed among them; and conceiving that the object which the Agricultural Society had in view in offering this premium, was to find out a substitute for turnips, each lot of cattle had a mixture of food allowed them, with the exception of lot No. 1, which was altogether fed upon turnips and straw, and may on that account be designated the trial lot; No. 2 had half the quantity or weight of turnips which was allowed to No. 1, with 30 lb. of linseed-oil cakes, as a substitute for the remainder of the turnips; lot No. 3 had the same weight of turnips which was given to No. 2, and had ground corn in place of the oil-cakes; the fourth lot got offal from a grain whisky distillery, and a portion of ground beans, which was mixed into their draff every morning. By following out this arrangement, we have ascertained the quantity of turnips saved,—the value of the turnips in feeding by themselves, contrasted with the other substances,—and their value as an auxiliary feeding when used with those richer substances, which, without some coarser food, will neither be an economical nor a beneficial food for cattle. All the lots had fresh straw given to them daily, which was not weighed, and below is a statement of the food consumed, and the expense incurred in the fattening of each lot:—

* Report made by Mr Brodie in 1837 on this subject in competition for the premium offered by the United East Lothian Agricultural Society.—Editor

Lot No. 1. fed on Turnips.

1836.					
October	12.	To price of five cattle, ...	L.55	0	0
	24.	... 10 days' keep of ditto on turnips and straw, at 8d.	1	13	4
January	1.	... 34 tons white globe turnips, at 8s. 4d. per ton, since 24th October till this date, being 10 cwt. per day, ...	14	3	4
April	7.	... 38 tons, 16 cwt. ruta-baga, at 12s. 6d. per ton, since 1st January till this date, being 8 cwt. per day, ...	24	5	0
			L.95	1	8
		At this date the Judges appointed by the Committee of Management, inspected the cattle, and reported their value to be L.82.			
June	7.	... 21 tons, 9 cwt. ruta-baga, since 7th April till this date, at 12s. 6d.	13	8	2
			L.108	9	10

The average expense of the keep of this lot is about 6s. 3d. per week each beast.

Lot No. 2. fed on Turnips and Oil-Cakes.

October	12.	To price of five cattle, . . .	L.55	0	0
	24.	... 10 days' keep on turnips and straw, at 8d.,	1	13	4
January	1.	... 17 tons white globe turnips, at 8s. 4d.	7	1	8
April	7.	... 19 tons, 8 cwt. ruta baga, at 12s. 6d. .	12	2	6
		... 1 ton, 18 cwt. foreign linseed-oil cakes, at L.7, 15s., per ton, since 16th November till this date, being 30 lb. per day, . . .	14	14	6
			L.90	12	0
		Estimated Value at this date, L.88, 10s.			
June	7.	... 10 tons, 15½ cwt. ruta baga, at 12s. 6d. .	6	14	1
		... 16 cwt. 38 lb. linseed cakes, at L. 8, .	6	10	8
			L.103	16	

The average expense of the keep of this lot, is about 5s. 9d. per week, each beast.

Lot No. 3. fed on Turnips and Ground Corn.

October	12.	To price of five cattle, . .	L.55	0	0
	24.	... 10 days' keep on turnips and straw, at 8d.,	1	13	4
		... 17 tons white globe turnips, at 8s. 4d. .	7	1	8
		Carry forward,	L.63	15	0

1836.		Brought forward,	L.63	15	0
April	7.	... 19 tons, 8 cwt. ruta baga, at 12s. 6d, .	12	2	6
		... 1 ton, 14 cwt. 98 lb. of bean-meal, or 63 bushels ground beans, weighing 62 lb. per bushel, at 5s.	15	15	0
		... 9 bushels bruised oats, at 3s. 6d. . .	1	11	6
			L.93	4	0
		Estimate Value at this date, L.77.			
June	14.	.. 10 tons, 14¼ cwt. ruta baga, at 12s. 6d. .	6	14	1
		... 1 ton, 9 cwt. 100 lb. bean-meal, or 54 bushels ground Beans, weighing 62 lb. per bushel, at 5s.	13	10	0
			L.113	8	1

The average expense of the keep of this Lot, is about 6s. 8d. per week each beast.

This Lot had latterly the rough seeds of oatmeal, at 1½d. per bushel, as a mixture to the bean-meal, which are not charged, being worth the price as manure.

Lot No. 4. fed on Distillery Grains and Ground Beans.

October	12.	... To price of five cattle, . . .	L.55	0	0
	24.	... 10 days' keep on turnips and straw, at 8d.	1	13	4
November	7.	... 3 tons, 5 cwt. white globe turnips, at 8s. 4d.	1	7	1
April	7.	... 72 quarters draff, at 4s. 6d. . . .	16	4	0
		... 60 puncheons dreg, at 2s. 6d. . .	7	10	0
		... 1 ton, 14 cwt. 62 lb. bean-meal, or 62 bushels ground Beans, weighing 62 lb. per bushel, at 5s. .	15	10	0
			L.97	4	5
		Estimated Value at this date, L.81, 10s.			
June	14.	... 37½ quarters draff, at 4s. 6d. . . .	8	8	9
		... 28 puncheons dreg, at 2s. 6d. . .	3	10	0
		... 19 cwt. 104 lb. bean-meal, or 36 bushels ground beans, weighing 62 lb. per bushel, at 5s. .	9	0	0
			L. 118	3	2

The average expense of the keep of this lot is about 7s. 2d. per week each beast.

At the commencement of these experiments, the different divisions of cattle had each their places, as well as kinds of food, allotted for them; and those of the trial lot, No. 1, whose feeding was destined to be turnips alone, from being the kind of food which they were formerly accustomed to, made a more immediate improvement than the cattle of the other lots, so much so indeed, that several of my friends who saw them during this period, could not believe that a proper division of the cattle had been made, as this lot was then, about the end of November, L.5 better than any of the other lots.

By the above statement, it will be observed that the feeding of the lot upon turnips and oil-cakes, was the least expensive mode which was adopted in making the experiments; and that these cattle made the greatest improvement (although after ten or twelve days' trial with oil-cakes, they were so obstinate in refusing them, that it was found necessary to take away their allowance of turnips for some days, and give them water in stead, before they were induced to begin). This was sufficiently proved by the marked difference in value put upon them by the judges appointed to report upon the comparative value of each lot, at the Society's Show in April. This continued in rather an increased degree during the remaining time they were here, particularly as contrasted with the trial lot, which was altogether fed upon turnips, having been estimated by good judges about the beginning of June, to be worth about forty shillings more each beast, than those of the trial lot.

The improvement of the cattle in lot No. 3 was much retarded by one of their number being naturally of such a restless disposition, that he himself would not take time to eat, nor would he allow the others to do so, and although the yard which they occupied was of sufficient size for a greater number, it was not until the turbulent ox was taken away and fed by himself, that the cattle made the improvement which they ought to have done; after that, however, a very perceptible improvement took place, and by adding a little to their daily allowance of ground beans, their value when killed, as it appears by the flesher's return, was very different from what it had been when valued comparatively with the other lots at the April show. This untoward circumstance, caused a greater expense in the keeping of this lot than would have been otherwise necessary.

In the charge against lot No. 4, it will be observed that keeping upon distillery offal is more expensive than the keeping of lots No. 2 and 3 with their half allowance of turnips. The turnips, however, were the produce of the farm, and the prices were fixed by the Committee, and high as they are, I could not have purchased turnips to carry here, unless by giving four or five shillings advance upon the ton weight; therefore a part of the charge against the distillery offal, will require to be set down.

for manure, and the same ought also to be deducted from the beans, which are charged at rather a full price*.

Upon the whole, it is evident by these experiments, that feeding with turnips as an auxiliary, has been the most advantageous mode of using turnips, as by the state it is apparent that if the cattle of lot No. 1 had only been allowed half the quantity of turnips which they consumed, and had got oil-cakes in lieu of the other half, as was given to lot No. 2, the expense of their keeping would have been lessened L.4, 13s., and from superior quality their value would have been increased L.10, making together L.14, 13s.; therefore, by bestowing the remainder of the turnips, with the addition of oil-cakes, upon other five cattle, the realization upon the turnips eaten by lot No. 1, would have been L.29, 6s. additional to what it has been.

These experiments were carried on for two months after the valuation was made at the show in April; as from an over supply in the market, caused by a scarcity of turnips, the cattle would not then have paid for their keep; but by continuing till June, I have been amply remunerated for all my outlay and trouble, without taking into account the great advantage of the additional and enriched manure of twenty cattle fattening upon the farm, where ten only could have been kept, had turnips alone been used for that purpose; and to any person at all acquainted with agriculture, it must be evident that one cart-load of manure made by cattle thus fed, will be at least equal to two, if the cattle had got only straw and water.

The above experiments, which are corroborated by those conducted last season by Messrs Andrew Howden and Alexander Brodie junior, tend to shew that the winter feeding of cattle is more capable of successful extension by those who have a sufficiency of straw, but who have not such abundance of turnips, as to be able to make all their straw into manure by cattle upon full feeding, than was formerly imagined.

From the cattle having travelled to Glasgow, their weight has not turned out in the manner it would have done had they

* We think that in all such calculations, the value of any produce consumed on the farm ought to be taken at what it really costs the farmer to raise it, and not at its market price, for that includes the profit on it; and it is surely unreasonable to attempt to superadd a profit above the profit included in its market price.—EDITOR.

been slaughtered nearer home; besides, from a very great dullness taking place in the butcher market there, Mr William Thomson, who purchased the cattle, found great difficulty in disposing of the beef so quickly as the time of lifting required, therefore lot No. 1, which was first slaughtered, had an advantage by not being allowed to fall off from being kept after being driven such a distance.

Live-Weight of Cattle before being travelled to Glasgow.

Lot 1. Fed on Turnips alone.	Stones.	Lot 2. Half Turnip & Oil Cakes.	Stones.	Lot 3. Half Turnip and Ground Corn.	Stones.	Lot 4. Draff, Dreg, and Ground Beans.	Stones.
No. 1 weighed	118	No. 1 weighed	115	No. 1 weighed	95	No. 1 weighed	109
— 2 ...	104	— 2 ...	118	— 2 ...	115	— 2 ...	109
— 3 ...	111	— 3 ...	105	— 3 ...	105	— 3 ...	129
— 4 ...	107	— 4 ...	122	— 4 ...	111	— 4 ...	110
— 5 ...	96	— 5 ...	92	— 5 ...	91	— 5 ...	88
	536		552		517		545

Flesher's Statement of the Weight of Beef, Tallow, and Hides.

The Carcasses in Imperial Stones; Tallow and Hides in lbs.

	Lot 1.				Lot 2.					Lot 3.					Lot 4.			
	Beef.		Tallow.	Hides.		Beef.		Tallow.	Hides.		Beef.		Tallow.	Hides.		Beef.		Tallow.	Hides.
No.	st.	lb.	lb.	lb.	No.	st.	lb.	lb.	lb.	No.	st.	lb.	lb.	lb.	No.	st.	lb.	lb.	lb.
1	62	1	112	96	1	61	11	108	86	1	51	9	119	79	1	57	0	119	72
2	67	2	104	83	2	61	8	115	97	2	63	0	84	85	2	54	6	90	60
3	58	12	101	75	3	55	12	115	77	3	57	5	118	76	3	66	1	112	77
4	54	4	98	68	4	66	9	146	84	4	59	12	115	75	4	55	6	82	50
5	50	12	99	69	5	49	12	97	62	5	48	0	84	62	5	46	9	112	78
	293	3	514	391		295	10	580	412		280	7	520	377		280	0	515	357

ON THE MANUFACTURE OF CIDER.

By Mr Towers, C. M. H. S.

The article on Orchards in the last number, p. 176, was expressly preliminary to the one which now is offered to the agricultural body in particular, though not exclusively, in order to prove, that sound-keeping cider can be made very cheaply in every county where good apples are produced. Whatever promotes the course of domestic economy, must be useful to those whose aim it is to nurse and make the most of a limited income.

My remarks shall, in a great degree, be strictly practical; the results of actual experience with fruit which has nothing in common with those kinds termed *par excellence* cider apples. But before I enter upon the particular detail, it will be proper to present the reader with a few extracts from works upon the manufacture of cider in the west of England: these will furnish leading ideas concerning the routine practice, which may be generally useful.

The first point of importance refers to the expense and prices in the large way. This I find under the head *Cider*, in the Penny Cyclopædia, vol. vii. p. 162.—"During the years 1833-4-5, the price in the hands of the grower may be thus estimated:—Of the best cider, from 1s. to 1s. 6d. per gallon; good, from 10d. to 1s. per gallon; family cider, used by farmers, and in public-houses, from 4d. to 10d. per gallon; 'drink' for labourers, from 2½d. to 6d. per gallon. These prices amply remunerate the farmer, who, in many instances, might increase his profits by a diminution of the cost of production."

The last observation is worthy of notice: it is relevant to every produce of the farm; for, "whatever is saved is earned." But it may be rendered still more comprehensive, by extending the idea to *increased production*. Were farming conducted upon the scientific principles of a well regulated *convertible* system and enlarged *rotation*, the crops might be doubled; and thus, the inestimable public blessing of low prices rendered compatible with remunerating profits.

The expense of cider to the domestic manufacturer, is the next point of consideration. The cost of the fruit must be an *ad valorem* calculation; because it must depend upon circumstances which will variously affect it. I presume that an orchard exists; and, in that case, the price will be little more than that of the labour bestowed in gathering it. The preparation of the fruit is readily submitted to calculation; provided there be a cider-press in the neighbourhood; but I shall give an estimate of the expenses incurred in that part of Berkshire where I reside, as, by it, persons at a distance may not only form an idea of the extreme cheapness of this beverage, but may be induced to introduce presses in the neighbourhood, where none are, as yet, to be found. The writers whom I have consulted, agree in their censures of the awkward machinery which is in general employed; and I can add my testimony to the justness

of their remarks, from having observed the construction of the ponderous presses that still exist in Somersetshire. These are lent out on hire, and require a waggon to remove them from place to place. Instead of encumbering the pages of the Journal with any further account of them, I will attempt cursorily to describe a very compact and useful press, which I have seen at a village not remote from Windsor. It is kept by a gentleman for the express purpose of pressing apples for any one who will send them to him. Those who wish to make a certain quantity of cider, may have the fruit pressed, at the cost of twopence for every gallon of juice, and at an hour's notice. My first experiment in this county was made in November 1835. I had 14 bushels of apples to spare; these were taken six miles in sacks with the barrels for receiving the juice. In a few hours, the juice was returned to me, with a charge of six shillings for 36 gallons, a surplus quantity remaining at the mill which the barrels would not contain.

This mill or press consists of two parts. The first is a sort of case or box firmly fixed to the floor of a barn; but it would stand in any common shed or outhouse, as it is little more than a yard long and two feet wide. There is at the top a wooden hopper to contain the apples; below that are two pairs of cylindrical rollers which have an involute action in opposite directions, one towards the other; the upper pair are of wood full of iron nails or pegs, which rend and tear the apples to fragments, and deliver them to the lower pair of cylinders, made of stone. They are about 9 inches wide and 18 inches long, placed very near to each other.

The mill is set in motion by two winches, fixed to two heavy and broad fly-wheels which are turned by two men. The fragments of apples are carried by the tearing-rollers, and delivered at the upper surfaces of the pressing stone cylinders; which, partaking of the same simultaneous motion, crush them to a complete pulp, and deliver that into a trough at the bottom of the case or box. Such is the tremendous power of the rollers, that the pips of the apples are completely smashed; and yet there is no appearance of effort, and scarcely any noise: nothing can be more compact or convenient.

The *Pomace* (as the pulp is termed) is now put into horse-hair

bags and placed on the stage of the press. This apparatus consists of a square case or frame about 4 feet wide, which rests upon the floor. The sides of the case are made of boards 8 or 9 inches wide; the bottom is of very thick and strong plank, and upon this the hair-bags are placed. A similar board of great substance is put over the bags, and this is forced by the action of two extremely powerful iron screws upon the bags. The pressure is first made by the hand, one man being employed at each screw, which he turns till juice ceases to flow. The shorter of two small levers is next passed through two of the handles of the screw, and thus an additional power is obtained. Finally, a longer lever is applied, and thus the pulp is deprived of nearly the whole of its juice. This simple and commodious press, that occupies the room of a moderately-sized table only, is capable of acting upon the pulp of 10 bushels of apples; and as each bushel of good fruit is supposed to yield 3 gallons of juice, 30 gallons may be obtained in a very few minutes.

Thus, I hope to have produced proof that there exists one apparatus at least, which is suitable to the farmer or private dealer, and only regret that I did not see the owner, from whom I could have obtained the address of the mechanist. The description I have given claims an apology; but at a future opportunity, I hope to obtain more accurate information on the particulars required, to make the press sufficiently known and understood.

We now come to the quality and due preparation of the fruit, points upon which authors are not agreed.

It will be of very little use to mention the apples of the regular cider districts in Herefordshire, Somersetshire, and Devonshire; they could not be easily obtained elsewhere, and might not succeed in every locality. The author of the article "Cider," in Baxter's Library of Agricultural Knowledge, observes that "those apples which are bitter as well as sweet, are well calculated for producing good and durable cider. Beyond all others, those which possess the above qualities, *hang longest on the trees*, yield the finest liquor, as cider cannot be made too late in the year. It is probably better to mix the sorts of fruit, observing that the *sweet* predominate over the bitter."

These remarks are worthy of notice; but the main fact is founded on the old prejudice, that as beers require a sweet and bitter principle (as found in malt and hops), so cider ought to

be made from two varieties of fruit, one of which should act the part of the hops in beer. Were this principle carried throughout in every process of fermentation, we must introduce bitters into our wines; the fact, however, is simply this:—the saccharine or sweet principle furnishes the alcohol of the fermented fluid, and equally in respect to malt as to the juice of the grape and other fruits. But the extract of malt is very liable to run into the acetous fermentation, and thus to become vinegar. The alkaloid bitter principle of the hops acts chemically as a preventive of this process, and therefore is essential to the perfecting of ale and beers. Hops in any form, even the very flavour which remains in a washed beer-cask, are extremely injurious to cider and all kinds of wine; and as these fluids require no reagent to prevent their gradual acetification, it is found quite sufficient to introduce sugar to a greater or less extent, in order to secure their excellence and durability. The juice of every species of apple can be converted to cider; but the choice is best determined by the specific gravity of the juice. That of ordinary apples may be estimated at about 1050, compared with water at 1000. The juice of some apples is much more dense, namely from 1063 to 1073, as announced by Mr Knight; and it certainly is of consequence that, if any juice be under 1065, it ought to be strengthened by adding sugar in one form or other, in sufficient quantity to bring it to the standard gravity. An instrument called a *saccharometer*, described by Mr Roberts, in his Treatise on British Wines, can be purchased for a few shillings; but any one who understands decimal fractions can find the comparative gravity of a fluid without an instrument. It would not be difficult, also, to prepare a standard of comparison, which would give a sufficiently accurate result without calculation: this shall shortly be noticed; but previously I will describe, in few words, the method which I have lately adopted to ascertain the specific gravity of every vinous fluid. A common capillaire bottle, with a neck rather more than three inches long, and half an inch wide at the top, is first accurately weighed; it is then filled with rain-water, so that the fluid stands at a level with the extreme rim of the neck, and again weighed: the temperature ought to be sixty degrees, but any degree will answer equally well, provided the liquor to be

tried be of the same temperature as that of the water. My bottle contains 3120 grains Apothecaries' weight, and this weight becomes the divisor. The water, after being weighed, is poured off, and the bottle shaken repeatedly, or suffered to drain for a minute or two, till not a drop remains in it. The saccharine fluid is then carefully poured into the bottle till it completely fill it, and the nett weight being reduced to grains (480 to the ounce Apothecary), gives the dividend. Suppose, for example, that the expressed juice of apples weighs seven ounces, that is 3360 grains, then 3360 divided decimally, by adding a cypher to every remainder, will produce a quotient of 1076, indicating an *excess*, which results from the quantity of *sweet principle* and vegetable extract held in solution.

Similar results may be obtained by dissolving a known quantity of sugar in any given volume of water, say in a pint, the eighth part of a gallon. If a pint of soft water (*distilled water* is the best, when attainable) weighs 7680 grains, then by gradually adding sugar, and noting the weight of the solution after every addition, a standard may be obtained by which to determine the quantity of saccharine matter existing in any juice. Two ounces and a-half Avoirdupois, of good loaf-sugar, dissolved in half a pint of rain-water, raised the specific gravity to 1096; any juice, therefore, which indicates a corresponding degree of gravity, may be safely concluded to contain extractive matters to the extent of five ounces in the pint, or about two pounds and a-half in the gallon. But water, when it holds *sugar* in solution, occupies increased space; and therefore it will be correct to say, that if fresh apple juice shew a gravity compared with that of distilled or rain-water (at the same temperature) of 1096, the quantity of the sweet principle which it contains must be equivalent to a sweet fluid prepared by dissolving five ounces of loaf-sugar in one pint of pure water.

These remarks are extremely important to the brewer and manufacturer of sweets, British wines, cider, and perry, because it is impossible to determine the strength of any liquor if the gravity or density of the wort, or sweets, prior to fermentation be unknown. *Wines* require the "must" to be of greater specific gravity than cider: it should not be below 1115, and this can usually be obtained by dissolving three pounds and a-half

of sugar in each gallon of juice; but good-keeping cider will not require the juice to be higher than 1070 or 1080, and this gravity may be procured by a very limited addition of some sweet material, such as moist or lump-sugar, pure honey, or strongly concentrated sweet-wort.

Preparation of Cider.—The juice being ready, the wooden vessels sweet and in good order, no time must be lost; for if the atmospheric temperature be at or above 45°, fermentation will commence almost immediately, and on the scientific management of this mysterious process, the quality of the product chiefly depends. The first prudential step consists in deferring the work till a late period of the year: mid-November is quite early enough; and those apples are to be preferred which hang on the trees to the end of October. It is usual to shake and beat the trees, but the practice is censurable; every apple ought to be picked off its spur, gently, by hand, to avoid doing injury to both. The fruit should not be piled in heaps on the grass, but be brought in baskets, *dry*, and in the soundest condition, and placed cautiously in a heap in some dry, airy room, and left to heat a little for some days. I know that, while some insist upon this incipient process of fermentation, others strenuously object to it; but the rationale upon which it is founded is simply the following, and it speaks for itself:—Apple juice is generally of insufficient gravity, and the fruit immature, and so far insipid. If the apples be gathered at noon of a sunny day, and laid in a mass, a slight degree of warmth is speedily generated, aqueous vapour is expelled, and in a few days a pleasant vinous odour becomes diffused. Thus far the juice of the apple is acquiring aromatic and saccharo-vinous qualities, and increases in density, therefore this previous process is one entirely favourable to the quality of the cider; but it ought not to proceed further, lest the putrefactive action be induced, and therefore the fruit should be forthwith submitted to the press, after every decayed apple has been removed.

If the juice be found of sufficient gravity, it should be put into an open deep tub, furnished with a wooden tap, inserted about two inches above the bottom. If it be found deficient in density, recourse must be had, as before observed, to means which will furnish saccharine matter. The least artificial of

these is to boil the juice till it be sufficiently concentrated; but there are objections to this process, although some cider-makers have adopted and recommended it. One is this, that neither copper nor iron boilers being fit for the purpose, one made of sheet-iron, perfectly well tinned, must be employed, and such a vessel is rarely to be met with. Again, boiling produces a great change in the quality of the juice, by causing it to break; that is, to deposite a portion of its gluten or *leaven*, and thereby to ferment with difficulty: it also gives it a peculiar flavour. The *fermentation* of the juice is a process of the utmost nicety, and upon it depends the excellence or worthlessness of the liquors. If the gravity be below the standard, and the weather mild, the liquor ferments rapidly and violently; the sugar becomes decomposed, and a poor harsh cider is the result. A strong and ponderous juice, abounding with the sweet principle, with a very low temperature (35° to 40°), are above all things favourable to a successful issue. I therefore propose the partial adoption of boiling in the following manner, and as this article is written for the domestic manufacturer, who, it is presumed, will commence his experiments upon a small scale, there will be little difficulty to bring the suggestion to proof. They who operate in the large way can readily modify the plan, by the erection of suitable apparatus. I presume that thirty-six gallons of cider are to be made,—the quantity of apples required will be about sixteen bushels, which ought to yield forty-eight gallons of juice; less will not cover the waste that is inevitably incurred. The juice may, on an average, be estimated at 1065, as compared with pure water at 1000. It therefore will require some adjunct to raise its gravity ten or fifteen degrees. The latter is to be preferred.

Without dwelling on minutiæ, which I have not had opportunity to confirm by positive experiment, but judging from the comparison of Robarts's tables of gravities with my own observations, I conclude that 7 lb. of loaf-sugar, or about 8 lb. of good honey, boiled in a tinned vessel with four gallons of the apple juice, will furnish the requisite quantity of saccharine matter. The boiling may be performed at one or more operations, to suit the convenience of the operator; and it should be continued so long as any material quantity of scum arise, and

till one-fourth of the fluid be carried off in steam. When cool, the liquor should be added to the unboiled juice, with which it must be thoroughly mixed. If the gravity be then 1075, the object has been attained; if not, another addition of sugar or honey is to be made. The great rapidity with which apple juice runs through the fermenting process, is complained of by all writers; therefore the abstraction of a portion of the leaven by a process which at the same time adds density to the juice, must tend to moderate the action of the portion that remains: and this is of great consequence; for as in *crude juice*, it almost invariably is found that the active power of the leaven is greater than the resisting power of the sugar, by boiling, and the addition of saccharine matter. *The balance of the two powers* is, to a certain extent, effected, and the liquor is brought under the command of the operator. The prepared juice is thus brought into a fit condition to be fermented; but here another perplexity presents itself; because cider-makers are at variance as to the first step to be taken, some requiring that the juice be exposed in an open deep tub, while others pour it at once into casks, and even bung them closely down. All, however, agree, that a cool room or cellar, and very low atmospheric temperature, are circumstances of the first importance. I tried the method of barrelling, and saw no reason to be satisfied with it; for notwithstanding every attention was given, fermentation proceeded with great activity, and threatened to render the cider dry and hard in a very short period,—a result which was only partially prevented by repeated rackings and injurious sulphuring. I subsequently met with a work, which, though out of date, contains many judicious observations, one of which I shall notice.

Mortimer's Art of Husbandry was written a great many years since. It is a quaint and curious production, seldom to be met with. A comparatively recent edition by one of his descendants, printed in the year 1761, once came into my hands for a few days; and in vol. ii. p. 382, I found directions for the preparation of cider. The apples he selects are what he terms Pippins (which title is now indefinite, but then was sufficiently explicit), and Pearmains particularly; these are to be gathered twenty-four hours before pressing. When the juice is expressed, it is to stand in an open tub, furnished with a tap,

for twenty-four hours, covered with sacks to settle. Draw off the clear, *leaving all the lees.* Sulphur-vapour the first cask, fill it to within three inches of the bung-hole, and leave that open. The open tub is to be cleaned from the first settlings, and kept ready; for if hissing begin in the cask, the cider is to be racked off into it, separating the lees in the barrel, reserving them to settle in an open jar. The cider is to remain to deposit more lees; it is then to be drawn off, and returned to the cask. Thus proceed, racking, separating, and moderately sulphuring the barrel till working be subdued.

The principle of this old practice is sound, the object being to prepare a cider which will retain a rich and somewhat sweet flavour. The lees deposited contain much of the natural ferment or leaven, and the removal of this checks or retards that hasty fermentation which would speedily convert the cider to an austere dry fluid, void of sweet and rich flavour. The farming labourers of the cider districts prefer this harsh beverage; but in private families it is desirable to retain the sweet principle in a quiet state of inaction till the liquor be bottled, when a very slow progressive action will cause the development of carbonic acid, and bring the cider into that condition which renders it sparkling in the glass and brisk to the palate. The vapour of sulphur (sulphurous acid gas) acts upon the leaven, and causes it to separate and fall down; but it is liable to introduce a foreign and permanent flavour, which is far from pleasant. I have just perused a sensible article, in a modern miscellany, on the subject. It shall shortly be alluded to when we come to the process of ripening.

The establishment of active Fermentation.—It is recommended to effect this by exposing the prepared apple juice in an open vat standing in a cool room or cellar, not merely for twenty-four hours, as directed by Mortimer, but till the saccharometer, or specific gravity test, indicate a loss of five or six degrees. Some quantity of froth will by that time have formed on the surface, and there will be a deposite of sediment. The froth should be skimmed off, the liquor drawn off from the lees, and tunned into a perfectly clean and sweet oak cask, into which the bung is to be loosely fitted. The following judicious remarks from the pen of Mr Crosse will exhibit the rationale of the So-

mersetshire practice :—" The fermentation should never proceed fi than to decompose one-fourth of the sugar in the liquor, leaving the when finished, in such a state, that it should contain, if possible, in an composed form, three-fourths of the sugar which it originally possessed

The loss of four or five degrees in gravity, prior to barre indicates the progress of fermentation. " This is a very imp crisis, as it is now time to give a decisive check to the fermentation whi commenced. The common, and perhaps most effectual way is by w called *stumming*, or matching the cask. It consists in first pouring one pailsful of cider into any empty cask, and then introducing, by mean wire, a lighted match, made of a piece of thick linen cloth, eight or ten in length, and one inch in width, smeared with melted sulphur, excepti part attached to the wire, which is wetted to prevent its being burnt. this is lowered into the cask, it is bunged tight; and after allowing su time for the sulphur to be consumed, it is rolled backwards and forwa a quarter of an hour or twenty minutes, that the liquid, being agitated, the more readily absorb the sulphurous acid gas formed. It is then fille cider, and in general the fermentation will be found to be decidedly c for some days, during which a large portion of gluten will have time to posited at the bottom, from which the liquor is racked into another cas

The cider will be quieted by this process, but as I fou 1835, between November 14th and December 31st, a cask be sulphured, and its contents racked week after week, ar every transition from a dry keen air to a moist and gentle perature will excite a renewed action, till at length a thi the liquor shall be lost, and the remainder offensively in with sulphurous vapour. How are we to obviate these a certain consequences, *hic labor—hoc opus est?* Concentrat the juice, partly by boiling, and partly by good sugar, or s sweetwort, offer the first preventive remedies. The deposit a good portion of the leaven in an open vat presents the se A moderate sulphuring in the first cask, after Dr M'Cu scientific method, may then be effectual, provided the liqu immediately conveyed to a cold cellar wherein the tempe is always equable.

It will now be necessary to describe the method just a to. Procure of a manufacturing chemist, or prepare, t termed *sulphite of potash*; it is rarely met with, and known; but any person versed in experimental chemist soon supply himself with it thus: Let one ounce of car of potassa be dissolved in four ounces of rain water and filt

pour this clear solution into a Woulfe's bottle with two necks. Put one or two ounces of concentrated sulphuric acid into a clean and dry Florence flask, and to *that* add one-fourth of its weight of pure powdered charcoal; connect the two vessels by means of a bent glass tube, so placed that the longer leg be immersed in the solution of potassa. Apply the heat of a spirit lamp, or small charcoal fire, or sand-bath, to the flask, sufficiently to excite the charcoal to attract some of the oxygen of the acid. Sulphurous gas will then pass into the solution. Continue the process so long as effervescence be occasioned; and, finally, evaporate the sulphurized liquid (previously poured into a flask) till a pellicle form on the surface. Then let it stand at rest to cool and deposite crystals. These, if properly prepared, will be manifestly sulphurous on the tongue. Dr M'Culloch assures us that no taste will be communicated to a vinous fluid, though all the effects of sulphuring will be produced by the sulphite. *One drachm of it will be sufficient for a pipe* of wine, &c. &c. It is to be dissolved in half a pint of the cider, and then poured into the barrel, which is to be agitated by stirring or rolling, and then left at rest to deposite the gluten. This it will do for a time, and to a certain extent; but the fermentation will be renewed, especially at changes of the weather. On this subject, and the criteria whence to judge of the condition of the cider, we once more recur to the authority of Mr Crosse. After noticing the extreme attention of the makers of the liquor in the barrels, in order to detect the first renewal of fermentation, indicated by a kind of hissing or singing, occasioned by the extrication of gas, he adds—"A very short continuance of this is destructive of much sweet in the liquor, and of the hopes of the manufacturer. *Singing* must be carefully distinguished from *fretting*—the former is the result of *active*, the latter of inactive fermentation; cider will *fret* for more than a twelvemonth after the cessation of active fermentation."

The sound occasioned by the slow, distinct, and equable action of *fretting*, is totally dissimilar to the rapid and increasing hum of singing, at the first symptom of which the liquor is to be instantly racked into another cask, the dregs being left behind, which are afterwards to be put either into a small cask or bottle. "Some ciders are much more obstinate in continuing to ferment than others. Five or six rackings may quiet one sort; whereas another may require more than twenty. It is said that some cider-makers are so watchful in this respect

as to remain up every night during a period of six weeks, leaving their servants to attend the casks during the day-time. The same cask is occasionally racked twice in twenty-four hours, and sometimes once a-day for fifteen or sixteen successive days." In this state of doubt and perplexity, with the certainty of a loss of the best liquor, to the extent of perhaps one-half of the bulk—authors leave us to the "skyey influences"—which, after all, it must be owned, govern the electrical developments of all fermentable matters. If sulphuring be resorted to in every racking—certain it is that the cider will acquire not only the peculiar flavour of the gas, but also an acidity foreign to that of the apple.

What are we then to do—what corrector are we to apply in order to tranquillize the energy of the leaven; or to remove it without deteriorating the fine aroma and rich saccharine flavour of the cider?

In the course of my experiments I have met with all those perplexing incidents which render the manufacture of cider a process of great nicety. On one occasion a barrel which appeared perfectly tranquil after a second or third racking, became disturbed by a change in the atmosphere, and the bung was driven out with violence. Great injury was sustained by this unexpected commotion in the liquor; the cider was hard and austere. The sulphurings were inefficient, yet they left a permanent flavour. The mention of this circumstance brings me to the consideration of that article to which I before alluded. It is hardly needful to avow that I have had no experience to establish or impugn the facts stated, because a week or two only have elapsed since they came under my notice. But there is so much reason to find a substitute for sulphuring, that I gladly give extended publicity to the article. It is verbatim as follows:

"*Cider.*—This being the season for making cider, the following hints from an experienced hand may prove interesting: I beg, on the subject of cider, to suggest a hint on the means of producing and preserving this agreeable beverage in the best state of mellowness, and also for preventing the general complaint against it by townspeople, that of harshness or sourness, a property it acquires from the imperfect state of the fruit, and the consequent too great abundance of fecula or fermentative principle in the juice. This mellowness is at present badly imitated by the use of brimstone; by which a portion of sulphurous acid is produced, and is found to render the fecula inert; by this means, however, a foreign and deleterious acid is introduced, and cider so

prepared, though sweet to the palate, is less wholesome than it would be if the fermentive principle were simply separated from the liquor; it being found that the presence of too much fecula continues the process of fermentation beyond the point at which it ought to stop, as well as occasioning its too rapid progress. For this purpose I recommend the use of animal jelly, and I have found that obtained from calves' feet to answer well in making English wines. I have used them in the raw state, as well as boiled into jelly, and find they answer in either way. Observation and experience can alone determine the quantity to be employed; at present, I recommend two or three pairs of calves' feet per hogshead, suspended from the bung-hole by a string to prevent them sinking quite to the bottom; if they are put in immediately on the cider being put into the casks, the fermentation will proceed till the liquor becomes fine, after which it will be much retarded, and perhaps a single racking will, by this means, be found sufficient. This, however, and the quantity of animal substance to be used, and the precise time for introducing it into the cider, must be determined by repeated and careful experiments. In making raisin and fruit wines, the calves' feet were put in after the fermentation had been going on for several weeks; the wine soon became fine, and the fermentation was retarded, or almost suspended. For a weaker liquor, like cider, it may be better to employ them very early. Since writing the foregoing observations, I have had a communication on the subject of making cider from an American farmer who resides in the state of Ohio. He informs me, that the cider in that country is, in his opinion, superior, both in quality and strength, to ours; and he attributes this superiority in part to their climate and fruit, but mainly to the difference of management. The method they now almost invariably pursue is, to put a pint of common mustard seed into every hogshead of juice or cider from the pound's mouth; and this simple expedient is found to preserve the cider from becoming hard, and to render racking more than once quite unnecessary. This appears to be a very easy method of effecting so desirable an object; it is not theoretical, but recommended by long established practice. Large growers may find it advantageous to raise their own mustard seed. Perhaps some may be desirous of learning how mustard seed should affect the fermentation of cider; this it may be somewhat difficult to account for quite satisfactorily. There is, however, one fact pretty generally known in this country, which may, perhaps, bear some affinity to it. It has been observed that cider, kept in a linseed-oil cask, which has been first properly cleansed, is always mellow, inasmuch that the farmers in this country give a preference to these casks. Now, it is known that mustard seed contains a large quantity of bland oil, and it may, perhaps, produce the same effect as the saturated staves of the oil-cask. It is also well known to brewers, that oil and grease added to wort retards the fermentation; any other seed, therefore, which yields a bland oil, may possibly answer as well as the mustard seed."—(Mag. Domestic Econ. No. xxviii. p. 119, 120.)

It will readily be perceived that I had anticipated the writer in his view of the *cause* of harshness, and endeavoured to obviate it by increasing the volume of saccharine matter in the

juice. If, after the separation of the sediment formed in the first open tub, the cider be transferred to casks *double-hooped* for strength, with the addition of twenty or thirty grains of *sulphite of potassa* to each eighteen gallons, and then bunged tightly down, the subsequent fermentation, in a cold cellar, from November to March, must be so subdued, that it will scarcely be productive of injury.

We have the proof every day before us (in the case of bottled stout ale, &c.), that carbonic acid, if forcibly compressed, does not manifest itself. The Hon. Charles Hamilton's experiments with wines made from the grapes of his vineyard at Pain's Hill, shew that pure juice, casked, and *bunged down* from the press, produced perfect wine. The grand difficulty was found in retaining the fluid during its first efforts. Could we, as it were, suffocate the cider by denying vent to the gas, the liquor would absorb *that*, and finally become tranquil; provided, first, that the enriched boiled juice were immediately barrelled, and bunged down in casks banded with strong hoops, and the heads pressed and supported by planks and screws; or, second, that after being partially fermented, and the lees separated, it were treated as above recommended.

Whatever tends to prevent the repetition of racking, without introducing a foreign flavour, must be an improvement.

It was my intention, when I commenced this article, to give the exact process, step by step, and almost in the order of a diary, by which I produced excellent cider; but when I had perused the paper last quoted, I determined to assume another style, preferring to give the reader an opportunity to improve upon routine, rather than to lay down specific rules.

The use of animal jelly may be followed by the best results: calves' feet should be tried upon one small quantity, whites of eggs upon another; soles' skins, well washed, appear to me to be nearly equal to isinglass, but should be added in sixfold proportion. Isinglass frequently fails to "fine" cider; but if a drachm of powdered catechu (formerly *Terra Japonica*, Japan earth) be rubbed in a mortar with half a pint of cider, and then poured into a twelve-gallon cask of cider, stirring and agitating the whole, isinglass will act upon the tanning, and carry down the feculent matter. If the American practice be proved by

fact, and linseed-oil casks act favourably upon the liquor, why should we not avail ourselves of *linseed* itself? The seeds abound with bland oil, which is free from the rank flavour of the expressed oil; they also contain much mucilage. Mustard seeds contain the latter, but the oil (the essential oil at least) is pungent beyond comparison. Sweet almonds are dear, otherwise their oil and albumen offer the best promise. Half a pound, bruised to pulp and incorporated with the whites of six eggs, would, I believe, combine all the requisite qualities of the articles alluded to in the paper on *Cider*, and be sufficient for eighteen gallons.

I have now combined, into moderate compass, all the data which comprise the theory of cider making; difficulties will arise, but they can be overcome, and even during a first experiment. But if the operator choose to try all methods, with little risk of loss, I would advise him to make use of six-gallon casks, or what would be better, to employ a double set,—the first to consist of casks containing each one gallon more than the second set. Thus, if the cider were barrelled from the vat in four seven-gallon vessels,—one to be sulphured,—the second to be tested with a suspended calf's foot,—the third with a tea-cupful of linseed or mustard seed,—and the fourth with three or four ounces of almonds and the whites of two or three eggs, he would (weather and situation being favourable) arrive at a rational conclusion in a very short period.

The first racking should be made into six-gallon casks; and, by whatever process the cider were rendered fine in the shortest time, and with the least destruction of the sweet principle, *that* ought to be made the standard of practice upon a larger scale.

All attempts to fine cider by isinglass, &c. ought to be made, after a first or second racking, when the weather is serene, and the liquor in repose. Bottling may subsequently be undertaken whenever the finings have produced brightness.

ON INSECTS MOST INJURIOUS TO VEGETABLES AND ANIMALS, AND OF THE MEANS BEST CALCULATED TO COUNTERACT THEIR RAVAGES. NO. II.

By James Duncan, M. W. S., &c.

The *Cataphagus obscurus*, which we succeeded in rearing last summer from a wire-worm precisely similar to that described towards the close of last paper, and which was mentioned as by far the most destructive species in this country, when in the perfect state has the body short, thick, and convex above, of an obscure dusky or brownish-black colour, clothed throughout with short greyish hairs; the wing-cases usually of a lighter hue than the rest, having the punctured lines placed at equal distances, and the intermediate spaces of a uniform colour. The latter circumstance distinguishes it best from *C. lineatus*, of which, however, it is likely to be a mere variety, as it corresponds to that insect in almost every other particular. When an attempt is made to seize these insects, they almost invariably contract their legs and antennæ, by which they are liable to slip through the fingers to the ground, where they lie for a time quite motionless; but if they happen to fall on their backs, they speedily jerk themselves into the air with a sharp snap, like a pellet sent from a pop-gun.

The larvæ of these beetles, which alone are noxious, have been ascertained to continue in that state four or five years before undergoing their metamorphosis; and during the whole of that period they live on the roots of corn and other grasses, and likewise attack the bulbs of turnips, carrots, potatoes, &c. The extent of the injury they sometimes occasion may be estimated from the fact, that a single worm has been observed to bite from eight to twenty plants in a very short time, and they are occasionally so abundant, that from four to eight have been turned up by the spade in a space of four square feet. They are by far most destructive in newly broken up grounds, gardens converted from pasture-lands, &c. Mr Spence relates that they prevailed for a time to a great extent in the Botanic Garden at Hull, and completely destroyed the annuals. The following calculation, whatever opinion may be entertained of

the data on which it is founded, will serve to shew the serious damage which these insects have been supposed to commit throughout the kingdom, by an eminent agriculturist who had frequent occasion to investigate the subject.

"The depredations of the wire-worm being principally confined to wheat sown upon clover leys, old pastures recently broken up, pea and bean stubbles, &c., we may suppose the general average of the injury to amount to about a twentieth part of what is sown upon this description of lands. This, I think, may be deemed a very fair and moderate calculation. The number of cultivated acres of land in England at the time in question was computed at seven millions, of which 2,400,000 were calculated to be sown with wheat, and as only one-half of the wheat sown is supposed to be on clover leys, old pastures, &c., our calculations must be confined to 1,200,000 acres, instead of 2,400,000: this will give 60,000 acres as annually destroyed by the insect in question; which replanted, at one bushel per acre, will require 60,000 bushels of seed, which, at 8s. per bushel, are worth L.24,000. Besides this, although no extra expense is incurred by the farmer in preparing the land, yet he has to pay for dibbling-in the seed, which, at 5s. 3d. per acre, will cost L.15,750, or at the full price, 6s. per acre, L.18,000. If the land require harrowing, there will be a further charge of 9d. per acre, or L.2,250, not to name other items, which render it difficult precisely to ascertain the loss of the farmer.

"If the above calculation be thought a fair one, and I see no reason why it should not, we find the quantity of wheat lessened to the market by the depredations of these insects is very frequently, if not annually, sixty thousand bushels, which occasions to the farmers an additional expense of at least L.15,750." *

When the fields lie fallow, these insects continue to feed on the grass and other weeds, which are frequently allowed to overrun the surface; whereas if the soil were kept clean, they would either die for want of food, or be compelled to remove to some other place.

It has been already stated that these larvæ invariably live beneath the surface of the soil; every plan, therefore, suggested for their destruction, must be founded on this consideration. Without adverting to this fact, many superficial applications, such as strewing the surface with quicklime, soot, &c. have been tried without effect. The most obvious remedy is to saturate the soil with some fluid which has been previously ascer-

* Linnean Trans. vol. ix. p. 158.—This calculation will not appear too high, at least for certain years, when it is recollected that the hop-fly (*Aphis Humuli*) sometimes occasions an annual loss of L.453,000 to the British revenue, and that the damage committed in a single county, Devonshire, by the turnip-beetle (*Haltica nemorum*), has been estimated by an eminent agriculturist at L.100,000 in one year.

tained to destroy the insects without injuring the plants, that is, if the latter be of a kind which it is necessary to preserve, as will usually be the case. In a fallow field this precaution need not be observed, as a double benefit would ensue from the destruction of both insects and weeds. More carefully conducted experiments, and on a more extensive scale than any that have yet been undertaken, will be necessary to shew what kind of liquid is best adapted for this purpose. Probably different substances will be found most useful in different situations, according to the nature of the soil and the chemical ingredients which enter into its composition. The latter consideration should be particularly attended to in all experiments on the subject, as most likely to suggest the most appropriate remedy; and it might even happen that the fluid employed to destroy the insects might be so managed as to produce a most beneficial change in the chemical qualities of the soil. If a strong saline solution, for example, should be found to kill the insects, as it is very likely to do, there are few soils which would not derive benefit from such an application. Of course many substances prove speedily fatal to these insects, and among these the choice would have to be determined by cheapness and ease of application. Beirkander, a Swedish observer, who has investigated their habits, found that they lived among

	Days.	Hours.
Garlic, - -	9	0
Spruce leaves, -	0	14
Fir leaves, -	0	12
Ledum palustre, -	0	9
Myrica gale, -	0	2
In water, - -	4	0

He suggests, that such of these plants as proved most speedily fatal should be mixed with the manure. He also considers it of great advantage to cause children to follow the plough, and pick up all that happen to be turned up. He states, that in this way he has seen 351 wire-worms collected in a field not exceeding 600 feet by 56.

Sir Joseph Banks suggested a very simple plan for alluring the wire-worms from the plants, and collecting them that they might be destroyed. This consisted merely in burying slices of potato stuck upon skewers, near the seeds sown. As the larvæ

are very fond of this root, they leave the young plants, and fix upon it. These slices require to be examined every day, and the wire-worms collected upon them destroyed.

A contributor to the British Farmer's Magazine affirms, that he has frequently freed fields entirely from wire-worms, by sowing a crop of white mustard seed. The experiment he has tried so frequently, and in circumstances so well calculated to demonstrate its effects, that he is perfectly satisfied that the remedy is efficient. "Encouraged by the results of my former trials, I sowed a whole field of forty-two acres, which had never repaid me for nineteen years, in consequence of nearly every crop being destroyed by the wire-worm; and I am warranted in stating, that not a single wire-worm could be found the following year; and the crop of wheat throughout, which was reaped last harvest, was superior to any I had grown for twenty-one years. I am therefore under a strong persuasion, that the wire-worm may be successfully repelled and eradicated, by carefully destroying all weeds and roots, and drilling white mustard seed, and keeping the ground clean by hoeing."*

Nature herself has taken means to check their superabundant increase by making them the prey of a small ichneumon, which searches out their retreats, and deposits its eggs in their bodies, which are consumed by the parasitical larvæ as soon as hatched.

Flea-beetles (*Halticæ*).

Under this name is included a numerous tribe of small insects, scarcely any of them exceeding two lines in length, and the greater number not above half these dimensions, all of which are herbivorous, and many of them attacking our most useful vegetables. They are at once distinguished from all other beetles occurring in this country (except a few of the weevil tribe, which are always sufficiently recognisable by their elongated rostrum), by having the power of leaping to a considerable distance by means of their hinder legs, the thighs of which are much thickened for the purpose. The external crust, or covering, is in most cases hard and polished, minutely punctured, either in lines, or irregularly; and not a few of them are adorned with very brilliant colours. By far the greater proportion of

* Mr Tallant in Brit. Farmer's Mag. 1831.

them are attached to cruciferous or tetradynamous plants, some feeding on several different kinds, and others confining themselves to a single species. They were all comprehended by Linnæus in his genus *Altica*; but the more careful examination to which they have been subjected since his time, as well as the many additional species discovered, has rendered it necessary to divide them into several generic groups. As every one who attends to the insects injurious to vegetation will have occasion to observe the depredations of several different kinds belonging to this family, it has been thought that it would be useful to subjoin the following synoptical view of the genera, translated from Stephens' Illustrations of Entomology, by which it will be easy to refer the respective species to their proper place in modern systems:—

Hinder tibiæ not dentate or spinous externally.
  Hinder tarsi short, inserted at the apex of the tibiæ.
    Body oblong-ovate.
      Thorax narrower than the wing-cases........HALTICA.
      ——— of the same breadth as the wing-cases......MANTURA.
    Body hemispherical.
      Antennæ with the joints simple........SPHÆRODERMA.
      ————— unequal........MNIOPHILA.
  Hinder tarsi elongate, inserted at the apex of the tibiæ..THYAMIS.
  ————— remote from the apex of the tibiæ....MACROCNEMA.
Hinder tibiæ dentate or spinous externally.
————— the head prominent........CHÆTOCNEMA.
————— spinous, head drawn within the thorax........DIBOLIA.

Species belonging to several of these genera are very hurtful to the produce of our fields and gardens; but the most troublesome are those composing the group to which the old name Haltica is still applied. One of them, *H. oleracea*, attacks cabbage, broccoli, &c., and often seriously injures the young plants, by consuming the leaves. But by far the most formidable enemy to the farmer and horticulturist is that species named *H. nemorum*, which feeds on the turnip. As one of the most constant and active depredators to which that invaluable plant is exposed, it is highly desirable that its history should be thoroughly investigated, with a view to the discovery of some efficient remedy; and we shall therefore proceed to mention the principal particulars which we have been able to ascertain in regard to it.

TURNIP FLEA-BEETLE *(Haltica nemorum)*.

This insect is usually called the turnip-fly, an improper designation, as it is thereby confounded with some other kinds detrimental to turnips, to which that name is much more appropriate. The above designation, first used by Mr Newman, and adopted by Mr Westwood, * is exceedingly characteristic, and free from any similar objection.

Besides the few concise distinctive characters indicated above, Haltica is characterized as a genus, by having the antennæ slender, and much shorter than the body, consisting of eleven joints, the first, or radical joint, being rather longest : the head transverse, that is, broader than long, which is likewise the case with the thorax ; the latter frequently with a transverse impression behind, and the posterior angles obtuse : tibiæ slender, the posterior pair with a simple spine.

The species named *Nemorum* (figured in Donovan's History of British Insects, vol. xvi. pl. 569, fig. 1.) varies in length from a line and a quarter to a line and a-half, or nearly the eighth part of an inch. It is smooth, shining, and of a brassy black colour, with a slight tinge of green, particularly on the wing-cases; the antennæ black, with the second and third joints, and the apex of the first, of a pale colour. The thorax is convex above, and pretty deeply punctured; the wing-cases, which are much wider than the thorax, likewise thickly and irregularly punctured, each of them with a pale yellow or slightly sulphur-coloured stripe, running along the middle, curved inwards posteriorly, and not reaching quite to the extremity; the underside of the body and thighs black; all the tibiæ and tarsi of a pale hue.

Several kinds occur presenting the above characters in a somewhat modified form, many of which have received different names from entomologists. Such are *H. flexuosa*, *H. sinuata*, *H. Ochripes* (Curtis, Brit. Ent. pl. 630), *H. intermedia* (West.), &c., which differ from each other chiefly in the colour of the legs, and the form of the longitudinal yellow stripe on the wing-cases. It is very unlikely that they are more than varieties of the same species; and however important it may be to

* In a useful paper on this insect published in Loudon's Gardener's Magazine.

discriminate closely allied kinds of insects in most other instances, it is of little consequence in the present inquiry, as all those mentioned, whether varieties or species, are alike prejudicial to the turnip, and are doubtless precisely similar in their habits and economy.

This little insect occasionally feeds on a variety of cruciferous plants, but as already intimated, it is more particularly attached to the turnip, which it attacks both in its perfect and larva state. When the plants have acquired some degree of strength, and the foliage is considerably developed, the injury done is usually insignificant, as the partial consumption of the leaves does not interfere so materially with their functions as to have the effect of diminishing the size of the bulb. In this respect the larva of the turnip saw-fly (*Athalia Spinarum*) is incomparably more to be dreaded, as its greater size and voracity demand a much larger supply of material. But unfortunately the favourite food of this beetle is the young plant, just as it is beginning to unfold the cotyledon leaves. These it consumes with the utmost avidity, both as a larva and full grown insect, and when it abounds, the field is often wholly stripped of its crop in a very short time. Indeed their powers of mastication are surprising for creatures of such small size. An individual who confined a few for the purpose of observing their habits, found that they consumed *ten* young turnip plants every day. This may serve to give an idea of the extent of their devastations when their numbers become excessive.

It may seem surprising, that after the numerous investigations that have been made in relation to the habits of these insects, our information on some points of their history should still remain somewhat incomplete. They are found to attack the turnip plants as soon as the latter make their appearance, and one of the difficult points to determine is how they are produced so speedily and opportunely. In regard to the turnip saw-fly, lepidopterous insects, &c. the process is obvious; the eggs being laid upon the plant by the parent fly, and the larva evolved more or less speedily, but always after the lapse of some considerable time. The appearance of the plant and insect being in the present case almost simultaneous, it has been thought difficult to conceive how the same process should be gone

through. Some observers have therefore expressed their belief that the eggs are deposited in the ground, and hatched by exposure to the sun and air. But to this supposition there are obvious and insuperable objections, and it is not in accordance with the usual economy of such insects as feed on the leaves of plants. Others have imagined, with more appearance of probability, that the eggs are laid on the seed, and as the latter germinate, the larvæ are hatched, and ready to commence their attacks. The first that seems to have advanced and acted upon this hypothesis, is a writer in the British Farmer's Magazine, who, supposing as he himself expresses it, that the egg was *inherent* * in the seed, tried the effect of preparing the latter in the same manner as is done with wheat before sowing. Having undergone this process, the seed was sown on a space of ten acres, and the preparation appeared to have been in some measure beneficial, for although he had reason to believe that the vegetative powers of the seed were impaired by it, the little that grew was quite free from the beetle, while that part of the field immediately adjoining, and sown with the same seed, not prepared, and ploughed on the same day, was covered with the insect.

Dr Pearson of Birmingham, in attending to this subject, thought that the white specks or dots observable on a large portion of turnip seed (in the proportion of about three out of five), were the insect's eggs. But he was compelled to abandon this opinion, because when the seed was sown in soil contained in pots covered with bell-glasses, no insects appeared.

An account of similar experiments has recently been given by a writer in some of the periodical works on Natural History, under the signature of Rusticus, which is the more deserving of notice, as it evidently proceeds, notwithstanding an affectation of ignorance and contempt of the scientific details of Natural History, from one accustomed to attend to the habits of insects. This observer states, that he had always noticed

* If it be meant by this expression that the egg was thought to be deposited *within* the substance of the seed, the notion could be entertained only by one utterly unacquainted with the structure of this insect, for it is unprovided with any thing analogous to a boring-instrument or ovipositor, which forms so indispensable an appendage to insects of a different economy.

that there was the greatest quantity of grubs on very young plants, that they were very various in size, and that it was not till the plants were a fortnight or three weeks old that the beetles appeared in any great quantities, yet there were some beetles from the very first coming up of the plant. "Now, I knew from experience," he proceeds, "that the turnip-beetle fed on wild mustard and several other hedge-plants, and therefore that it was not at all an improbable thing, that when they smelt the fragrance of the fresh bursting cotyledons of their favourite food, they would skip down from their spring habitations, the hedges, and commence the attack. This would account for the few beetles observable from the first, but not for the numberless grubs that covered the cotyledons, riddling them with holes, and devouring the succulent stems, even that part which was covered by the ground. These must have sprung from eggs either left in the ground last year, or have been laid on the turnip seed itself, and harvested with it in the autumn." * With a view to determine this point, he first sowed some seed in a flower-pot, when the insect appeared in abundance; he then enclosed the pot with pasteboard, with the same result; it was then covered with the utmost care, so that no insect could possibly get admission to the plants, and yet the beetle is said to have appeared in profusion. By this it was thought to be proved that the insect did not come from other plants, and that it must, therefore, emanate either from the soil or the seed itself. The fourth step was to bake the earth in a cast-iron pot, and the precaution was used of watering the plants sown in this soil only with water which had been previously boiled, and at the same time covering them as before, so that no insect might be admitted from without. In these circumstances the Haltica appeared in abundance. The only inference that the case now seemed to admit of was, that the eggs must be attached to the seed; and, upon actual inspection, a number of white flattish substances were perceived adhering to the surface of the seeds. In order to destroy these supposed eggs, the seeds were steeped in brine, that is salt dissolved in water, for the space of twenty-four hours. The seeds so treated did not germinate; † but

* Entomological Magazine, vol. i.

† But for instances of similar inadvertency, it might seem superfluous to

when soaked in the same liquid for only three hours, they grew freely, and no beetles were observed upon them.

Had these experiments been conclusive, or conducted in a satisfactory manner, the result would have been important; for if it had been once proved that the eggs were attached to the seed, means might readily have been devised for destroying the one without injury to the other. But it appeared, *a priori*, very improbable that the insect would place its eggs in a situation where they must of necessity be buried, and the young larva consequently exposed to numerous casualties before it reached the surface, where, unlike the wire-worms, it is destined to live and obtain its food. And that such a nidus cannot be the real one, is proved, as Mr Westwood remarks, by the fact that turnip plants grown for seed are gathered before the pods burst open, and consequently cannot be reached by any insect unprovided with a penetrating ovipositor. Rusticus himself was subsequently convinced that his experiments led to erroneous conclusions, and now expresses his conviction that the eggs are not laid on the seed.

It is not an uncommon opinion that they are deposited in manure, but this notion is certainly unfounded, as appears from reasons similar to those already mentioned. It is utterly inconsistent with the provident care and economy of insects to place them in a situation where they would be exposed to continual risk, or where they would be buried in the earth, for the larva, on first appearing, are unable to provide for themselves, unless their food be immediately before them. In these circumstances we are inevitably left to try to reconcile the observed facts with the ordinary and ascertained habits of similar insects which feed on plants. These, as is well known, are accustomed to place their eggs on the leaves of the vegetable which forms the appropriate food of the larvæ, and the latter, accordingly, have nothing to do but commence operations the moment they emerge. The only consideration which presents the least difficulty in as-

recommend that great care should be taken in regard to the treatment to which seeds are subjected in this respect. Such as contain much mucilage are materially injured by a long immersion even in pure water. When the liquid is of such a nature as to have some chemical action on the seed, of course the destruction of the vegetative principle may be instantaneous.

serting that the same thing takes place with the Halticæ, arises from the short time that elapses before the beetles make their appearance. In a properly prepared soil, the seedlings begin to appear on the fourth or fifth day after sowing, and if the insects are not observed from the first, they at all events appear in profusion a very short time after. Although Rusticus states that he found grubs of various sizes on very young plants, he affirms that it was not till the plants were a fortnight or three weeks old that the beetles were observed in any numbers; but in most cases they certainly abound much earlier. The eggs are unquestionably laid upon the seedling plants by beetles which have passed the winter in a dormant state, concealed among the herbage, in moss, chinks in walls, under bark of trees, &c. and which have supported themselves by feeding on the cruciferous plants which abound in fields and hedgerows, till they can have access to their favourite food. They are often found in such situations as those alluded to in the winter, sometimes in very considerable numbers; indeed the family Halticidæ, generally, may be said to be less affected by the cold than most other allied tribes. I have repeatedly found the common little species, with pale wing-cases, and a dusky streak along the suture (*Thyamis atricilla*), as well as another nearly related species (*Thyamis tabida*), creeping about with some activity among the grass even in the middle of a mild winter. It is probable, therefore, that no inconsiderable number generally survives, and it is these that are observed among the turnips when they first come up. It is likely that a great profusion of the perfect insect will seldom be observed till sufficient time has elapsed for the first brood to be hatched. Some of the plants in the same field are almost in every case more advanced than others; and when the larvæ are found on a seedling which appears just to have burst through the soil, it is more likely to have come from the larger plants than to have had any previous connection with that newly sprung. Although these insects can fly, they are scarcely ever observed to use their wings; and it may be confidently affirmed that they never migrate in large bodies from one field to another. However great the numbers may be, they have all, therefore, been produced (except the hybernating parents) in the field which forms the scene of their depredations.

But the short time that elapses before the grubs and perfect

insects appear, certainly implies that their development and metamorphosis are more than usually rapid. The egg seems to be hatched shortly after its exposure, the larva speedily to go through the various stages of its growth, and the state of pupa to be of similarly brief duration. In the case of those insects which feed on the foliage of plants in their larva state, and afterwards derive their aliment from other substances, the general law seems to be, that a much longer duration is assigned to the former than to the latter; and it may be that this is not observed in regard to such as always consume vegetables, because in either of their conditions they serve the same purposes in the economy of nature to which the prolonged existence of the larvæ bears reference in the other instance. Mr Westwood has traced the metamorphosis of some of the insects belonging to the same family as the Halticæ, and infers, from analogy, that the transformations of the latter must be comparatively rapid. The *H. nemorum* may even differ in this respect from other members of the same genus which feed on mature plants, in accommodation to the somewhat peculiar circumstances in which it is placed. Parallel examples are of frequent occurrence among insects. Unless the eggs of the common flesh-flies were hatched with extreme rapidity, the larvæ when they appear would neither obtain their appropriate food in perfection, nor fulfil the useful purposes to which they are now subservient.

The means that have been proposed for the destruction of this insect vary according to the views which different individuals have taken of its history. The losses it has occasioned to farmers have been so great, that almost every expedient has been employed which promised the least likelihood of success. A great variety of substances, supposed to be offensive to it, have been assiduously applied both in the form of powder and otherwise; it has been entrapped in several ways, and enticed to leave the plants it is so desirable to preserve by the offer of other food. Several of these plans it will be proper to mention more in detail, as useful hints may occasionally be derived from them; but it may be asserted that a remedy, combining the two grand requisites of efficiency and economy, is still in some measure a desideratum.

If the beetles from which the subsequent broods originate hy-

bernate about the roots of hedges, which, as above intimated, many of them are known to do, and feed during early spring on plants belonging to the same natural family as the turnip, it is obviously of great utility to clear out the bottom of the hedges in the winter, and thereby kill them by exposure to the cold, and to destroy all the weeds which might afterwards afford a supply of food. Indeed, it may be affirmed to be one of the best general precautions against the increase of noxious insects, to keep the ground at all times as free from weeds as possible, and especially the borders and hedge-bottoms, as they are often left in such a state as to become a nursery from which they speedily propagate themselves, whenever a favourable opportunity occurs. On the supposition that the eggs are deposited in the soil, Mr Sutton, in a pamphlet he published on the subject, recommends that the fallows should be prepared for the seed, and then left undisturbed for about a fortnight, whereby he conceives the egg would be destroyed for want of proper exposure to the vivifying influence of the sun and air; but, as his theory can scarcely be doubted to be erroneous, any plan founded upon it will be unsatisfactory.

Several methods of treating the seed have been practised, not on the supposition that the insect's eggs were in any way connected with it, but on the principle that the young plants may imbibe certain qualities communicated to them from the seed, which will render them distasteful or nauseous to the insect. It certainly appears in no way improbable that the plant in its infant state, when alone it is exposed to imminent danger, may receive a sufficient taint by taking up in its sap a portion of the substances brought in contact with the seed to effect this purpose. The substances that have been tried with this view are oil, brine, and sulphur, and the result, in many instances, seems to have been highly satisfactory. Sometimes the seeds have been steeped in milk, with a little brimstone added; and I have just been informed, that a farmer in Forfarshire completely saved his crops from the beetle for a long series of years, by keeping the seed for some time previous to sowing among a considerable quantity of flour of sulphur, and sowing the sulphur along with the seed. In this way the juices of the plant might be tainted by absorption, so that the insect had no relish for it, while the

disagreeable odour arising from the sulphur strewed in the soil would help still farther to drive it away. The sulphur was found in no degree to injure the vegetative powers either of the seed or plant. This plan was followed by the farmer alluded to for fifteen years with complete success, his turnips being quite free from the insect, while his neighbours continued to suffer from its depredations.

One of the most easy and most generally adopted remedies is, to dust the seedling plants with some kind of powder. Soot, ashes, &c. have been used for this purpose, but there can now be no doubt that by far the most useful application of this kind is quicklime. It should be applied as soon as the plants break the surface, and repeated at intervals as occasion may require. "Lime is so common that it can be had in all situations, and it is so cheap that the cost need not at all embarrass the farmer. The labour in applying it is so comparatively small, that it is capable of being generally adopted. If the fly should not appear, the lime can be used for other purposes, and no loss beyond the labour of carriage will be incurred. We may congratulate the farmer on the satisfactory testimonials in favour of this last method of preservation, and may hope it will be found of the greatest possible benefit, conjoined with other steps which have been before alluded to. We trust the careful and systematic use of lime will obviate, in a great degree, the danger which has been experienced from the turnip-fly." *

Various methods, also, have been recommended and followed with a view to entrap the perfect insect, or at least to disturb its operation and dislodge it from the plant. The smell of elder has been known from the time of Linnæus to be particularly offensive to most insects, and, being thought to be so in the present instance, bush harrows made of this shrub are sometimes drawn along the turnip fields. The following plan has been occasionally adopted, but it cannot be recommended for its efficiency. A board, about eighteen inches wide, and of sufficient length to cover four ridges at a time, is made to run on wheels, at such a height as to brush the plants without injuring them.

* Report of the Doncaster Agricultural Association on the Turnip-fly, and the means of its prevention, founded on returns received from 102 correspondents in differents parts of England and Scotland. London: 1834.

The lower side is painted white, and the paint frequently renewed to keep it in a moist state; as this is drawn along it disturbs the insects, which jump up and stick in the paint. A piece of canvass is sometimes used instead of a board. But one of the most effectual plans for securing the perfect insect, and attended with least trouble in the application, is to employ the large bag-net, first described and figured by Mr Kirby, the invention of Mr Paul of Starston in Norfolk, and used with much success to clear his fields of these troublesome visitors. Having already described this implement, and recommended its use in freeing the plants from the caterpillar of the saw-fly, it is unnecessary in this place to do more than refer to it.*

Gardeners are much in the habit of using a mixture of soap and water for the destruction of noxious insects, and as it is said to be very effectual in regard to the Haltica, it may be used with advantage for the preservation of beds and other small plots in gardens, should it be found inconvenient to apply it on a larger scale. The receipt for this mixture, as given by Mr Major, in his Treatise on Insects prevalent on fruit trees and garden produce, is one pound of soap added to twelve gallons of strong soap-suds from the wash-house, or, in case of suds not being at hand, six gallons of soft water to one pound of soap. This mixture is best applied by means of a garden-engine, and when of the strength indicated it kills the insects. Indeed, it is important to be kept in mind that the depredations of these creatures may always be much checked by the application of any kind of liquid, as moisture is so highly prejudicial to them that they are seldom found to abound in very wet seasons. Sprinkling the plants with pure water in very dry weather has usually been attended with much benefit.

It will probably be in the recollection of some of our readers that not many years ago the late Sir John Sinclair, whose active mind was incessantly turned to all that effected directly or indirectly the interest of agriculture, published an account of a method for guarding against the ravages of this beetle, first practised by Mr Poppy, an eminent farmer near Ipswich. This plan does not lay claim to the merit of any new discovery, but consists in affording the insect such a supply of its favourite food

* See vol. vii. page 567, of this Journal.

as shall be sufficient both for its purposes and those of the farmer. With this view he sowed thick rows of turnips alternately with thin rows, the latter being intended for preservation, and the former to invite the attacks of the Haltica. The preference they never failed to shew for the thick rows is owing to the well known fact, that all plants in their infant state grow more rapidly and less fibrous when thickly sown than when they are thin; consequently these were earliest, and afforded the most plentiful and juicy repast. When the ridge system is adopted (which is now so generally the case) the ridges may be drilled alternately thick and thin; or the rows which are to be preserved for a crop may be sown on the top of the ridge, and the thick rows (to be afterwards destroyed) in the hollow between the two ridges. To drill thick for a crop is likewise considered a remedy, but the objection to this is, that it draws up the plants in a weakly state, and if wet weather comes on, they are not only much injured, but the difficulty and expense of hoeing them is increased. By adopting Mr Poppy's plan this objection is obviated, for the plants sown for a crop will wait any time without injury, while the thick sown rows will do no harm; and when the purpose for which they are sown is completed, they may be cleared away by horse-hoes, and the flies in them destroyed. By adhering to the above plan, Mr Poppy states that he never failed to rear a crop in any soil and in any season.

If this scheme has been found to answer when pursued in the manner described, there can be no doubt that it would be rendered perfectly effectual, by the simple addition of strewing lime on the rows intended to be preserved; for if the insects are not partial to the thin rows when their attractions are not greatly inferior to those of the others, they will surely avoid them altogether when they thus become positively distasteful. But the great objection to this plan is the trouble attending it, and the expense it entails both in labour and seed. It does not frequently happen, even when the insect is abundant, that it causes a total failure of the crop; and it should not be forgotten that in this, as in every other case, even a valuable result may be purchased at too great a price.

When it is found impossible entirely to prevent the unwelcome visits of these insects, it will occur to every one that the best means of ensuring a sufficient crop is so to promote the

growth and vigour of the plants that they may be able to sustain the attacks to which they are exposed from this quarter without suffering material injury. With this view of the subject, the Doncaster Agricultural Association, formerly alluded to, have published recommendations, which it will be of advantage to subjoin, as they embody the experience of a large number of practical agriculturists.

"Most effectually to insure the speedy growth of the plant, the land should be kept in the best possible state of cultivation.

"Scuffling or ploughing the land before winter, and clearing the hedge bottoms, and every other place that can harbour the insect, should be systematically attended to.

"The fallow should be completed as early as possible, so as to give an opportunity for choosing a favourable season for sowing.

"The system of ridging the land with manure under the rows, and drilling on the ridge, should be adopted in every possible case.

"The most favourable opportunity for ridging should be chosen, and it ought to be particularly observed that the land be not ridged in too dry a state.

"As soon as the land is opened for the manure, it should be laid in, the ridges formed, and the seed drilled immediately. The quicker these operations follow each other, the better chance there is of a good crop.

"The manure chosen should be adapted to the soil, and such as is likely to insure the speediest growth of the young plant, and a full quantity ought to be allowed.

"The seed should not be deposited in the manure, but the manure thinly covered with soil, and the seed drilled in this soil.

"A very liberal allowance of seed ought to be given, as much as 3 lb. or 4 lb. per acre for drill, and 6 lb. or 7 lb. for broad-cast, and the seed should be of one year's growth.

"As soon as the plant appears above ground, it should be dusted with quicklime, and this repeated as often as rain or wind beats it off and the fly reappears.

"In places which suit, and in seasons particularly dry, watering by a watering machine should be resorted to.'

ACCOUNT OF THE GREAT ANNUAL SHOW OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND AT DUMFRIES.

This great Show was held for the second time at Dumfries on Wednesday 4th October. The place selected for the exhibition was Mr Howatt's field in English Street, immediately contiguous to the town. Pallisades encircled the field as a fence, against which pens were erected for the stock, after the manner of the show-yard at Ayr, and other places. The pens for the sheep occupied the centre of the ground. The ladies' gallery was so situated as to command a view of the whole ground. The ground being irregularly shaped and undulating gave a picturesque effect to the whole exhibition. The weather had been very wet for some time before the show, and particularly on the preceding day. The show-day, however, proved dry and beautiful, sustaining the remark which has been frequently made, that the Heavens have always smiled auspiciously on the great meetings of the Society; and certainly, if the promoting of a nation's welfare may expect the blessing of Heaven, there is no Society, humanly speaking, deserves so large a share. The preliminaries were all admirably arranged by the local Committee and the deputation of Directors, under the auspices of the Lord-Lieutenants, Vice-Lieutenants, and Conveners of the counties of Dumfries, Kirkcudbright and Wigton. For the accommodation of the great dinner, to which 1260 sat down, a wooden pavilion was erected adjoining the Assembly Rooms. Its roof was supported by two rows of columns; its interior decorated with pink and white cotton cloth; and illuminated with ornamental gas lustres and sconces. The general effect at the time of dinner was very striking; and it deserves remark, that its proportions were so just that every person within it heard and saw with perfect ease every thing that was said or done.

With regard to the nature of the stock exhibited, to decide on the condition of which was the principal object of the Society's meeting, there were many fine animals, although, we think, that the general quality of the stock shown last year at Perth was superior. This fact would lead to the conclusion, that the stock in the midland counties around Perth, within the influence of the Society's district, are generally

rally better than those in the south-west portion of the country. It was pleasing, however, to remark, that a decided improvement in that respect has taken place since the time of the Society's last show at Dumfries in 1830. Then only one short-horn ox was shown; now were shown a number of breeding stock of that valuable race of cattle, which, although not of first rate excellence, with the exception of a few brought from a distance, yet their increase indicates the existence of a desire to cultivate the best breeds of stock. There is no other way of accounting for the decided inferiority of the Galloway bulls shown, which ought to have been exhibited in perfection at Dumfries. That the magnitude of the Society's show deterred many possessors of fine bulls from exhibiting them was not the sole cause, at least, of the paucity of number and inferiority in quality of the Galloway bulls, is evinced by the fact, that at the local show, held at Thornhill a short time before the meeting at Dumfries, the judges withheld the premiums destined for Galloway bulls, on the ground that none exhibited were deserving of a premium. The Galloway cows were generally good, and certainly better than the bulls, but there were few very superior cows among them. And yet all the young Galloway stirks and queys exhibited were excellent animals, and would have conferred credit on any part of the country. We own our inability to explain this anomaly in the result of breeding. Of the Ayrshire breed those exhibited were fully better than those shown at Ayr, which may be accounted for on the supposition, that the best stock bred in Ayrshire are carried off to other districts. There were no Angus or Aberdeenshire cattle brought forward.

The Leicesters exhibited proved that the finest quality of that valuable breed has not yet reached Galloway and Dumfries, although we have no doubt they will ere long occupy all their low lands, particularly after the land has been drained. The Cheviot sheep were very fine, and we question that better could be shown any where. We are glad to observe the cross between this breed and the Leicesters cultivated in this part of the country, and have no doubt that the superiority of the cross over the pure Cheviot will be the means of introducing the pure Leicesters themselves extensively. The Black-faced sheep were also good. Indeed, taking all the varieties of sheep together, we

may venture to express our opinion that the whole exhibition of sheep was superior in quality, as well as in number, to any other show of the Society.

In horses the exhibition was deficient and inferior, particularly in the fillies. There was a black stallion of fine figure, strength, and action, belonging to Mr Steedman of Boghall, near Edinburgh, which would have carried the prize had he not been thought too large for farm-work. According to the generally received opinion, that the male imprints his characters more indelibly than the females on the progeny, there may be a risk of breeding from too large a horse for the usual purposes of the farm; but, on the other hand, it is frequently seen that small stallions and bulls produce large stock. Of all the properties of a breeding stock, size, we conceive, to be more mutable than any other. Provided the blood be pure and fine, we would not hesitate to breed from any stallion or bull be his size what it may.

Among the implements there were some deserving of notice. The turnip seed-box for regulating the discharge of the seed by a simple contrivance, is a great improvement on the common clumsy box for sowing turnip-seed. This implement, attached to a very simple framing, was exhibited by that ingenious mechanic Mr Geddes, Cargen Bridge, Dumfriesshire. The equirotal carriage, exhibited by Mr Buchanan of Glasgow, appears to be a decided improvement. It permits the whole carriage to turn upon a pivot placed between the two bodies of the carriage, so that the fore wheels are as fixed and large as the hind. This construction must facilitate the draught to the horses, and it necessarily dispenses with the perch.

The exhibitions of butter and cheese were large, and of good quality; and the roots and seeds deservedly attracted universal attention.

The entire exhibition was larger than at any other of the Society's shows, 784 head of animals having been entered, being 278 more than was exhibited at the last show of the Society at Dumfries. The money collected at the gates amounted to L.380, a sum indicating the presence of 7600 persons, and when we mention that there must be an attendant on each lot of every description exhibited, considerably more than 8000 persons were present.

The following gentlemen were appointed judges of the respective classes :—

For *Galloway Cattle.*—Sir James Graham, Bart. of Netherby; Mr Andrew Dalgairns, Ingliston; Mr Patrick Kirkaldy, Fullerton; and Mr Miller of Ballumbie, from Forfarshire.

For *Short-Horn Cattle.*—The Marquis of Tweeddale; Mr John Grey, Dilston, Northumberland; and Mr John Heriot, Ladykirk, Berwickshire.

For *Ayrshire Cattle.*—Mr Bartlemore, Seaside; and Mr Findlay, Lyonstone, Ayrshire.

For *West Highland Cattle.*—Mr Lorne Campbell, Roseneath.

For *Cattle of any breed.*—The same Judges as for the Short-Horns.

For *Horses.*—Mr Dick, Lecturer on Veterinary Surgery in Edinburgh; Mr Walter Cossar, Dunse; and Mr James Stewart of Gillesbie.

For *Leicester Sheep.*—The same Judges as for the Short-Horns.

For *Cheviot Sheep, not fat.*—Mr Graham of Shaw, Annandale; Mr Elliot, Eskdale; and Mr Kennedy, Nithsdale.

For *Cheviot Sheep, fat.*—Mr Pagan, Liverpool.

For *Black-faced Sheep.*—Mr Gillespie, Douglas Mill, Lanarkshire; and Mr Lorne Campbell.

For *every kind of Cross in Sheep.*—The Marquis of Tweeddale; Mr Grey, Mr Heriot; and Mr Handley, M. P. for Lincolnshire.

For *Swine.*—Mr Pagan; and Mr Wetherell, Durham.

For *Extra Stock.*—Mr Handley; Mr Charles Stewart, Hillside, Dumfriesshire; Mr Hunt of Pittencrieff, Fifeshire; and Mr Wightman, Courance, Dumfriesshire;—assisted by the Judges of the corresponding classes in competition.

For *Butter and Cheese.*—Mr Hill, Edinburgh.

For *Implements.*—The Duke of Buccleuch; Mr Heathcoat, M. P. for Tiverton; Mr Parkes, Lancashire; Captain Johnston, R. N., of Cowhill; Mr Stewart, Cairnsmuir, Dumfriesshire; and Mr Slight, Curator of the Society's Models, Edinburgh.

For *Roots and Seeds.*—Sir William Jardine, Bart. of Applegarth; Mr Hannin, Drumlanrig; Captain Johnston; Mr Lawson, the Society's Seedsman; and Mr Henry Stephens, Edinburgh.

For *Wool.*—Mr Nixon, manufacturer, Hawick.

For *Sweepstakes.*—Mr Bartlemore; Mr Findlay; Mr Gillespie; Mr Campbell; Mr Dick; Mr Cossar.

CATTLE.

Of the Galloway Breed, 85 animals were entered for competition, namely, 7 bulls, 19 cows, 18 queys, and the remainder oxen and young stock. The small number of bulls, 4 of the whole number being bull stirks, of the indigenous breed of the counties, cannot fail to excite surprise, for the comparative large number of cows evince that this breed is still extensively cultivated, and the general excellence of the cows exhibited, also proves that it has not been deteriorated. Indeed, there is no danger of deterioration in quality, or diminution in number in Galloway stock, so long as it shall con-

tinue to be favourites in the London market. Comparing them with the kindred breeds in Angus and Buchan, they exhibit superior disposition to fatten, and lay on more flesh on the most valuable points. Amongst the competitors of this class of stock we are pleased to record the names of the Earl of Galloway, Earl of Selkirk, and Mr J. J. Hope Johnstone of Annandale, M. P.

The Premiums awarded were as follows:—For the Class of Bulls, the first premium of twenty sovereigns, or a piece of plate of that value, was awarded to Mr William Marshall, Kirkland; and the second, of ten sovereigns, to Mr Alexander Sproat, Brighouse.

For the Class of Bull Stirks, calved after 1st January 1836, the premium was awarded to Mrs Sproat, Grennan.

For the best pair of fat oxen, calved after 1st January 1834, the first premium of ten sovereigns was awarded to Mr Mure, Grange, and the second to Stair H. Stewart, Esq. of Physgill.

For the best single fat ox, the premium was awarded to Mr Hope Johnstone.

For the best pair of speyed heifers, calved after 1st January 1834, the premium was awarded to Mr Mure, Grange; and for single speyed heifers, calved after 1st January 1833, the premium was also awarded to Mr Mure, Grange.

The first premium for Cows was awarded to the Earl of Galloway; and the second to Mr William Sproat, Borness.

For the best pair of queys, calved after 1st January 1835, the first premium was awarded to Mr William Sproat, Borness; the second to the Earl of Selkirk; and the third to Stair H. Stewart, Esq.

In the class of stirks, calved after 1st January 1836, the first premium was awarded to Mrs Sproat, Grennan; and the second to Mr Alexander, Culeagrie.

In this class of stock the Judges commended the fat ox belonging to Mr Mure, Grange, as an animal of great merit; as also the cows belonging to Mr William Gilkerson, Beaumont, Cumberland, Mr John Mackenzie, Barnhill, and Mr John Maxwell, Westwater. They considered the whole class of queys calved after 1st January 1835, as being very superior.

In the class of Short-horns, the number of animals entered for competition was twenty-one, comprising six bulls, four bull stirks, seven cows, and four heifers. It is pleasing to observe the extension of this fine race of animals, more especially in this part of the country, as at the former Show of the Society at Dumfries, there was no breeding stock of this class exhibited. In the class of bulls, the first premium of twenty sovereigns was awarded to Mr William Mylne, East Lothian, and the second premium of ten sovereigns to Mr George Reid, Ballancrieff, in the same county. The honorary silver medal was awarded to the breeder of the best bull. The young bulls were considered by the Judges as undeserving of commendation. In the class of cows, the premium of ten sovereigns was awarded to John Stewart Lyon, Esq. of Kirkmichael. For the best heifer calved after the 1st of January 1835, the first premium was awarded to Mr John Graham, Kirkandrews-upon-Eden, Cumberland. The Judges remarked that all the heifers in this class were very good.

In the class of Ayrshire stock, although the number of competitors was limited, there were some fine specimens exhibited. There were six bulls,

eleven cows, and fourteen queys. For the best bull calved between January 1834 and January 1835, the premium of fifteen sovereigns was awarded to Mr Allan Kilpatrick, Millreoch, Ayrshire. Mr James Speirs, Raithill, was the breeder of this bull, and to him was awarded the honorary silver medal. For the best cow, the first premium of ten sovereigns was awarded to Mr James Wilson, Knockshinnoch, Ayrshire; and the second premium to C. G. S. Menteath, Esq. of Closeburn. For the best pen of queys, calved after the 1st Jan. 1835, the first premium was awarded to Mr James Newbigging, Poniel, Lanarkshire; and the second to Mr George Lorimer, Kirkland, Dumfriesshire. Commendation was passed by the Judges on the bulls belonging to Mr Theophilus Paton, Swinlees, and Mr William Milligan, Nether Dalpedder. The queys belonging to Mr William Walker, Kelburne Place, Ayrshire, and Mr John Borland, New Cample, Dumfriesshire, were also favourably noticed.

The first and second premiums for fat oxen of the West Highland breed, were awarded to C. G. S. Menteath, Esq. of Closeburn.

For the best fat ox of any breed, pure or cross, calved after the 1st January 1833, the premium of ten sovereigns was awarded to J. Stewart Lyon, Esq. of Kirkmichael, for his white ox. The Judges expressed their opinion that the two short-horn oxen exhibited by Mr Lyon in this class were fine animals, and in perfect maturity.

Horses.

Of horses there were exhibited in competition sixteen stallions, nineteen brood mares, six draught geldings, and four fillies. Amongst the stallions there were some fine animals, but the fillies possessed no merit. The premium of twenty sovereigns for the best Draught Stallion from three to twelve years old, was awarded to Mr Loudon, Cranstoun, Abington, Lanarkshire. For the best Stallion, from three to twelve years old, for breeding coach or chariot horses, the premium of twenty sovereigns was awarded to the beautiful bay horse belonging to Mr Robert Moffat, Scaleby, Cumberland. For Brood Mares, the premium of ten sovereigns was awarded to Mr George Hislop, Moat, Cumberland. For three-years-old Draught Geldings, the premium was awarded to Mr James Smith, Roberton, Kirkcudbright.

Were it not that it was considered an animal of too great size and strength for agricultural purposes, the stallion belonging to Mr James Steedman, Boghall, near Edinburgh, would, in the opinion of the Judges, have deserved the premium. This animal possessed perfect symmetry and fine action.

Sheep.

The Sheep Stock brought forward in competition, were numerous, indeed, more so than at any former General Show, there being no fewer than 512 head exhibited. The first in order was the Leicester breed, in which the first premium of ten sovereigns, for Tups not exceeding five years old, was awarded to Mr William Marshall, Kirkcudbright; and the second, to the Duke of Buccleuch.

For Shearling Tups, the premium was awarded to Mr William Brodie, Upper Keith, Haddington.

In the Class of Ewes, the premium was awarded to Mr Sober Watkin, Plumpton Wall, Cumberland.

In the Cheviot breed, for the best three Tups not exceeding forty-three months old, the first premium of ten sovereigns was awarded to Mr William Aitchison, Menzion; and the second, to Mr James Brydon, Moodlaw, Dumfriesshire.

For the best pen of ten ewes, not exceeding six years old, the first premium of ten sovereigns was awarded to Mr James Brydon, Moodlaw, Dumfriesshire; and the second, to Mr Thos. Little, Pennyland, Dumfriesshire.

For the best pen of ten Gimmers, Mr Little also obtained the premium.

For fat Wethers, not exceeding fifty-six months' old, the premium was awarded to Mr Thomas Laurie, Terreglestown, Kirkcudbright; and for fat Wethers, not exceeding thirty-two months old, Mr Laurie also obtained the premium.

In the Black-faced breed, for tups not exceeding forty-three months old, the first premium of ten sovereigns was awarded to Mr R. M'Turk, Hasttings-Hall, Dumfriesshire; and the second to Mr James Welsh, Braefoot, in the same county. For Ewes, not exceeding six years old, the first premium was awarded to Mr Andrew Weir, Linburn, Ayrshire; and the second to Mr James Milligan, Kirkhope, Dumfriesshire. For Gimmers of the same class, the premium was awarded to Mr James Milligan, Hayfield, Dumfriesshire. For fat Wethers, not exceeding fifty-six months old, Mr Thomas Robertson, Broomlee, Peeblesshire, obtained the premium, and Mr Charles Stewart of Hillside, Dumfriesshire, obtained the premium for fat Wethers, not exceeding thirty-two months old.

For Wethers of a cross between Cheviot ewes and Leicester tups not exceeding twenty months, the first premium was awarded to Mr James Mitchell, Bankhead, Dumfriesshire; and the second to Mr Thomas Laurie, Terreglestown. In the class of any cross, under thirty-two months old, Mr Laurie also obtained the premium for his wethers. For Lambs from Cheviot ewes, by Leicester rams, and dropped from the 1st of March, the premium was awarded to Mr Archibald Roden, Duncow, Dumfriesshire; and for Lambs, a cross between Cheviot or Black-faced ewes and any ram, except Leicester, the premium was awarded to George Bell, Esq., Woodhouselees, Dumfries-shire.

Swine.

For this district of the country the competition for swine was very limited The first premium, being eight sovereigns, was awarded to Richard Tinkler, Esq., Eden Grove, Westmoreland, for a boar not under 12 months, and not exceeding four years old; and the second premium in the same class, was awarded to Mr James Wilkin, Tinwald-Downs, Dumfriesshire. The Judges reported that the Sows exhibited in competition, were not of sufficient merit to deserve premiums—and in the class of young pigs, there was even no competition.

Extra Stock.

A great variety of stock was produced under this head, many of them possessing much merit. Premiums were recommended for bulls belonging to the fol-

lowing exhibitors, viz. to Mr John Cleland, New Dairy, Mr Laurence Drew, Carnyle Mills, Mr Anthony Rigg, Torkatrine, and Mr John M'Kenzie, Barnhill. For Cows, to Mr John Cleland, Mr Laurence Drew, and Mr Studholme, Kingmoor House, Cumberland, and also to this last-mentioned exhibitor a premium was recommended for a short-horn heifer. For oxen, premiums were recommended to be voted to the Duke of Buccleuch, for two very fine dun West Highlanders, to Mr John M'Queen, Auchenhay, for two Aberdeen polled stots, commended as store cattle; and to Mr William Martin, Dardarroch, for a two-year-old Galloway stot. For two very fine speyed Galloway heifers, a premium was recommended to the Earl of Galloway. For Leicester sheep, premiums were recommended to Mr John Bell, Harraby, Cumberland, Mr Wm. Purvis, Burnfoot, and Mr Jas. Wilkin, Tinwald-downs. For eight Cheviot tup lambs, to Mr William Paterson, Twiglees, and to Mr Thomas Little, Pennyland, for ten Cheviot ewe lambs. For Black-faced sheep, to Mr Adam Blacklock, Minnigaff; Mr Jas. Milligan, Hayfield, and Mr Hope Hunter, Kirkton. For a colt a premium was recommended to Mr Chas. Philip, Craikup; for a very good mare and foal to Mr Jas. Church, Tower of Sark; and for a foal to Mr Thos. Dalzell, Holm. The stallion, Grey Wiganthorpe, belonging to Mr Fergusson, Cumberland, was highly recommended by the Judges as a breeder of coach and hunting horses. For pigs, in this class, premiums were recommended to be awarded to P. Miller, Esq., Forrest, and to Mr John M'Turk, Pennershaughs. All the Stock exhibited by Mr Lawrence Drew, Mr John Cleland, and Mr John Lorimer, were favourably noticed by the Judges.

Implements.

In this department the exhibition was extensive, and excited considerable interest. Premiums were recommended to Mr Charteris, Dumfries, for a model of hydro-pneumatic pump; to Mr Geddes, Cargen-bridge, for a turnip-drill, with an improved seed-discharger; also a plough, with a sowing apparatus and harrow attached; and likewise a turning-machine, for making rake and fork handles; to Mr John Hamilton, Torthorwald, for various agricultural implements of good workmanship; to Mr John Harris, Dalscairth, for the workmanship exhibited in the manufacture of a double paring plough; to Mr John Hunter, Morton Mill, for a machine attached to a common cart for filling and rolling the ruts of roads; to Mr Thomas Hamilton, Ryedale tile-works, for specimens of drain-tiles of superior texture. Mr Buchanan of Glasgow exhibited what he styles the "equirotal" carriage. A subsoil plough, convertible into a draining and trenching plough, was exhibited by the Muirkirk Iron Company.

Roots and Seeds.

The exhibition in this department excited considerable interest, for, besides the splendid collection of Messrs Lawson and Son of Edinburgh, the nursery and seedsmen to the Society, there were no fewer than twenty exhibitors, each of whom exhibited good specimens; and premiums were recommended to the following exhibitors, viz.:—To Mr Thomas Smith, Penfillan, for a new potato from Chili, and for a new white carrot with green top; Mr Robert Robson, Gallowberry, for a new early oat, weighing 45lb. per bushel; Mr R. Arthur, Walltower, North Berwick, for fifty-two varieties of seedling

potatoes; Mr William Skirving, Liverpool, for improved Swedish turnips, Mr James Biggar, King's Grange, near Castle-Douglas, and Mr Thomas Kennedy, Dumfries, for superior rye-grass seed; and Mr William Hodson, Walton, near Whitehaven, for superior Swedish turnips. The various specimens of seeds and roots exhibited by Messrs William Samson and Co., Kilmarnock, Mr J. Hannay, Dalquhan, Mr Thomas Hannah, Mosside of Maybie, Mr Andrew Duff, Denvale-Park, Mr James Smith, Ayr, Mr Glover, Torthorwald, Mr J. Johnstone, Conheath, William Maxwell, Esq. of Carruchan, Mr Daniel Macnaughtan, Airdrie, near Kirkbean, and Patrick Miller, Esq. Forrest,—were considered worthy of notice.

Amongst several new and rare species of seeds and plants exhibited by Messrs Lawson and Son, we cannot refrain especially noticing the following, viz.:—The Rohan potato; the golden globe mangel wurzel; a very luxuriant specimen of *Vicia villosa;* the Cumberland new early oat, and the winter oat; Italian and Annat barleys; new ten-rowed Chevalier Wheat; diamond drop wheat; Whitworth's prolific wheat; Russell's white wheat, and Victoria spring wheat; *Chenopodium quinoa*, from the mountainous northern districts of South America; an improved Heligoland bean; *Poa nemoralis var. nervosa;* the Gama grass from North America; Alsike clover from Sweden; several species of melilots; *Pinus uncinata* and *pyrenaica*, obtained from the Pyrenees through the kindness of Sir John Nasmyth, Bart., of Posso; and interesting specimens of the *Pinus Austriaca* and *sylvestris*, exhibiting the comparative superiority in growth of the former.

Butter and Cheese.

The competition in this department of the products of live stock was numerous, and the various specimens exhibited considerable excellence. The first premium for butter was awarded to Mrs Fairbairn, Westerkirk, Langholm; and the second premium to Mrs Trainer, dairywoman, Hensol. The first premium for full-milk cheese was awarded to Mrs Janet Mackie, Limekilns, Annan; and the second premium to Mr Gavin Hamilton, Little Milton, Kirkcudbright. For skim-milk cheese the first premium was awarded to Mrs Janet Mackie; and the second Mr William Niven, Barnmuir, Closeburn, Dumfriesshire.

Wool.

For the best lot of combing wool, of seven fleeces, the premium was awarded to Mr William Marshall, Kirkland, Kirkcudbright.

For the best sample of white Cheviot wool, the premium was awarded to Mr Robert Laidlaw, Nether Cassock, Langholm.

Sweepstakes.

The competition in this particular department was extremely limited, and only consisted of Ayrshire bulls, the sweepstakes on which was gained by Mr Theophilus Paton, Swinlees, Ayrshire; of Ayrshire queys, gained by Mr George Lorimer, Kirkland, Dumfriesshire; of Mares, gained by Mr Lawrence Drew, Carmyle Mills, Lanarkshire; of black-faced tups, gained by Mr Robertson, Broomlee, Peeblesshire; and of black-faced ewes, gained by Mr Andrew Weir, Linburn, Ayrshire, and Mr James Milligan, Kirkhope, Dumfriesshire.

The agricultural body in Dumfries and Galloway deserve much commendation in inducing Mr Heathcoat to bring his steam-plough to Dumfriesshire. They subscribed the handsome sum of L. 100 to assist in defraying the expenses of its carriage from Lancashire. It was exhibited on the farm of Grain, in the Locher Moss, about seven miles in a south-east direction from Dumfries, near the ruins of Caerlavrock Castle. The site may have been well suited for exhibiting the peculiar powers of the machine, but a part of the road to it was almost impassable for carriages, and the moss itself was so soft as scarcely to be able to carry the foot of man. Its exhibition, however, excited great interest, and attracted the notice of thousands, many of whom however went away impressed with very different notions of its utility.

On a more minute inspection than formerly of the steam-plough, we find that the descriptive sketch which was given in No. 37. of the Society's Transactions, vol. xii. p. 72, was so essentially correct as to render any repetition of its description unnecessary on the present occasion. A more detailed account of the mechanical part of the plough may be found in the account published in Dumfries by Mr Ambrose Blacklock, Surgeon.

The principal interest which agriculturists feel in regard to this plough arises not so much from its peculiar construction, as its comparative capability to perform its work with the common plough, for unless it can perform its work as well, expeditiously, and with more economy than the latter, it will confer no boon on agriculture. It would be going too far to assert that Mr Heathcoat's plough is really a substitute for the common plough ; but it should be borne in mind, that it is only an experiment, and that experiment has been chosen by its inventor to be tried on a species of ground which is not well adapted for the operation of the common plough. On this account the two implements are not fair objects of comparison. The steam-plough certainly cuts the edges of the fibrous furrow-slices, and lays them over in a very perfect manner. It renders the rough surface of the wet bog an uniformly smooth plane. The ingenuity displayed by Mr Heathcoat to effect these results, has never been equalled, far less surpassed, and he certainly deserves the gratitude of agriculturists for attempting to solve a problem

upon which few men would have had the disinterestedness to devote so large a sum, and for which still fewer possess the requisite genius.

The few remarks which we shall make on the utility of this plough for agricultural purposes will be entirely of a practical nature. The first is, the mere ploughing of moss will never effect its drainage. We observe in Mr Blacklock's remarks on this subject, that much stress is laid on the fact of the inversion of the rough sod letting loose much water which runs away. This may be the case in any wet bog, such as Locher Moss is composed of, but the mere riddance of a little surface-water will never drain such a bog as to make it practically capable of bearing even coarse grasses, far less crops of any kind. To plough bog in so wet a state, is, in our opinion, just lost labour. It should first be thoroughly drained, and the plough might then be employed to turn over its surface as a preparation for succeeding white or green crops. But the machine may be converted into an engine for the drainage of moss, which in the first instance is of much more importance to it than ploughing. It could cut drains at stated distances by means of a plough constructed for the purpose, and dried peat would form excellent material for filling them up, in the same manner as we have seen successfully practised in the Bog of Allen, which every one knows is in Ireland. The rough surface, by being inverted, may not, will not in fact be soon decomposed, but it will in time become consolidated, and the surface will again be covered with the same kinds of wild plants that had been put out of sight by the ploughing. Without previous draining, therefore, it were a fruitless attempt to cultivate deep wet bog, but with draining effected by this engine, we have no doubt the plough would then cultivate it in a very efficient manner. But the smooth surface left by the plough can only be cultivated on dried, not wet moss. Nor do we see how that surface, even when dried, can be made serviceable to the raising of crops, without being ploughed, for it presents no irregularity of surface for the harrows to lay hold of and form a mould in which the seed may be inclosed. The smooth inverted furrow, therefore, may expedite the decomposition of the rough surface of moss, but the mould during the decomposition to

be successfully cultivated, will have to be ploughed on the principles of ordinary ploughing, and not with the steam implement, as presently constructed.

Of the two objections which Mr Blacklock, p. 15, notices, having been made against the use of the steam-plough, the one that it may be shivered to pieces, or the band broken, could not have been made by a practical person. The clipping and cutting apparatus attached, indicate in the clearest manner, that the plough is only intended to move through soft moss, and, in such situations, the only obstructions that are likely to present themselves are the trunks and roots of trees, which are very seldom so near the surface as the depth of the furrow-slice. The second objection against the weight of the machine, Mr Blacklock has not succeeded so successfully in removing; for, if the weight and position of the tender are found sufficient to counteract the resistance of the plough-furrow, there is no necessity, as far as the ploughing is concerned, for making the engine heavier than the tender.

There is nothing to prevent the application of the steam-plough to the cultivation of ordinary land. A plough could be more easily contrived to practise ordinary tillage than the present moss-plough, and the power of the engine could be made commensurate with the requisite draught. But before the principle of Mr Heathcoat's engine could be adopted for the purpose, the ordinary system of ploughing would have to undergo an entire change. The furrow-slices being all laid over in the same direction, ridges would have to be dispensed with, and as the ploughing is simultaneously pursued on both sides, the engine will require to pass either along or across the middle of the field. In the former case the ploughing would always be a cross-furrow; in the latter, the furrows on either side of the engine will be short in all fields of small breadth. To preserve the direction of the furrows to the inclination of the ground, and at the same time avoid forming a headland across the middle of the field, the engine should traverse either headland along the side of the field while the tender was moved along the other. This would decidedly be the preferable arrangement, provided the headland chosen were straight, for unfortunately the engine cannot move along a curve. But before any of these me-

thods could be practised, that is, before the land can be laid perfectly flat without a ridge, it must be previously thorough-drained. The objection to the present structure of the steam-machine being unable to turn on a curve, appears to us insuperable. In that case how can it enter and leave fields?

Whether all these difficulties to the use of the steam-plough in ordinary culture will ever be overcome, it is at present impossible to predict, but nevertheless we expect to live to see the day when they shall have been overcome.

THE AGRICULTURIST'S NOTE-BOOK, NO. I.

Embankments from the Sea.—There seems to be no operation connected with agriculture which promises more immediate and important results than the reclaiming of submerged lands in the estuaries of our large rivers. Till within these thirty years, the sole object contemplated in embanking submerged grounds, seems to have been the exclusion of water from the surface of soil which required only to be protected from its occasional invasions, and kept dry merely to make it eminently fit for most productive cultivation. Within the last twenty years, a system has been entered on, and is now, in the Forth and Tay in particular, being carried out to the most astonishing extent, not only of bringing into a cultivable state lands already, but for the periodical submergence, fit for cultivation, but of causing rivers to precipitate their mud in convenient localities, and so of creating fields where nothing before existed but a gravelly river bed, covered by from eight to twelve feet of water every tide, of the most unprecedented and unlooked for productiveness.

In the Forth, 350 acres of this sort of land have been, in the last twelve years, reclaimed by Lady Keith, at a cost of about L.21,000, and affording an annual return of about L.1400, or nearly seven per cent. In the Tay, seventy acres have been recovered, opposite to the shores of Pitfour, 150 on those of Errol, and twenty around Mugdrum Island, making in all 240 acres, at about an outlay of L.7200, yielding an annual rent of about L.1680, or upwards of twenty-three per cent.! On the Errol estate alone, 400 acres are just about to be embanked, in addition to the above 150, all of which may probably be in cultivation be-

fore 1847. Off the shores of Seaside, a wall just now being built, 800 yards in length, will effect the recovery of not less than 150 acres; and on Murie property, 50 acres might be taken in by seed-time 1838. The operations of the embanker, which began off Pitfour in 1826, will thus probably have been brought into cultivation before 1846, on a shore of not more than seven miles in length, no less than 810 acres of land, renting at from L.6 to L.7 per acre, or of a gross annual value of L.5670, and a gross total value, at twenty-five years' purchase, of L.141,750. This is a clear creation of L.117,450 of new agricultural capital, taking the reclaiming cost at L.30 an acre. The junction of Mugdrum Island to the north shore, would probably afford 1000 acres at a single operation, while thrice that surface might be obtained betwixt Errol and Invergowrie.

The capabilities of the Forth, over and above what has already been effected above and below Kincardine, are not much, if at all, behind those of the Tay, though no sufficient inquiry has been made to permit details to be gone into.

The basin of Montrose affords a surface of nearly 3000 acres, all capable of embankment, and which, by being relieved of the salt water of the ocean, which every tide at present overflows them and keeps them submerged for twelve hours out of every twenty-four, and irrigated by the fertilizing current of the Esk, which, for at least forty days every season, bears along with it not less than $\frac{1}{800}$th part of its weight of the richest mud, might speedily be made not less productive than those of the Forth or Tay.

It is probable that between North Berwick and Montrose are to be found the most favourable localities for embanking on the east coast of Scotland, if not indeed the only ones which could be made available with a sure prospect of profit. It would be at the same time well that the debouchures of all our great rivers were examined, lest at the mouths of the Spey, the Dee, the Don, the Esk, and the Tweed, might lurk localities equally accessible to the embanker, and equally unlooked for or more than in the Tay or Forth thirty years since.

If the harbours on both sides of the Forth be examined, as low down as Dunbar on the one side, and Crail on the other; and those on the Tay down to Broughty Ferry; those on the

Esk to Montrose and Ferryden, large quantities of silt will be found accumulating in each of them, quite as impalpable and fine, and probably, if freed of salt, as fertile as those deposited and taken in higher up the rivers. It is probable, then, that lands might be embanked much farther out in these estuaries than seems at present to be suspected, by much the greater part of the argillaceous flocculi which the river bears along with it being actually carried out to sea.

The various embankments hitherto completed have been constructed by those manifestly little acquainted with hydraulic engineering, with little concert amongst the proprietors, and without almost any recognition of general principles or systematic plan of procedure. Many anomalies are consequently apparent in the now finished works, and many cases of useless expense and annoying inconvenience have arisen, which it would have been most desirable and not difficult to have avoided.

On these and on many other grounds which must be apparent, but to enter into a detail of which would be much too tedious for the present memoranda, it seems most important that something should be done in the way of a historical account of all the embanking operations of any importance in Scotland, whether for the purpose of merely defending lands previously existing, but liable to periodical inundations, from tides or river freshes, or for the purpose of obtaining and inclosing accumulations of silt, which, but for the skill and industry of man, would have been wholly swept away.

Potato Failures.—It is a general remark there have been no failures in the potato crop this season, that is, there have been seen no such blanks in it as have been observed for some years past. This is true, and yet there may have been a failure, a partial one at least, in the crop. From all we have observed, and the information derived from others, we believe there has been an unusual number of small potatoes in the crop this season, although the quality of all, both small and large, is most excellent. This result might have been anticipated from what was evident in the state of the growing crop in summer. Some time after the planting, it was observed, that, although every set brairded and grew, yet many plants continued puny and

slender compared to others. This distinctive feature in the growth of the plants was less observable during the rapid progress of vegetation in the warm weather, than after the stems began to decay in autumn, when the smaller plants again indicated their inferiority. There can be no doubt these small plants have produced most of the small potatoes complained of. We think it extremely probable, that, had the weather not been so very propitious to vegetation after seed-time, the usual failures would have been experienced in all those spaces occupied by the small plants. Whether this is the general conviction on the state of the potato crop we have no means of ascertaining, for the agricultural reports do not generally pay much attention to the rationale of results; but we are quite satisfied that a little reflection on what most farmers may have observed in the state of the crop whilst growing, will lead them to this conclusion regarding the result of the crop. As it is, the fact of the crop having disappointed general expectation in regard to prolificacy, strongly supports the view we have taken of its condition. Now all these phenomena are quite in accordance with the theory of deterioration in the potato. The fine weather after planting sustained the vitality of the set, and maintained its growth afterwards; but the weather, be it ever so favourable, could not infuse undecayed vigour in a deteriorated constitution. Hence it could not produce vigorous large plants from the deteriorated seed, nor could it induce small plants to foster large tubers. Were the heating of the seed the true theory of the failures, the finest weather could not possibly have revived its vitality; besides the management of the seed having been unchanged for many years, places an insuperable barrier against the theory of heating. But it has been suggested, to account for the failures, that the land is tired of growing potatoes, as it has evidently tired of growing red clover. If so, the finest weather could not induce the land to grow a large and fine crop of potatoes, which the present is, any more than it could produce a large and fine crop of red clover which is now rarely to be seen. Till we see a better propounded, we shall embrace the theory of the deterioration of the potato, which has been so well treated and illustrated by Mr Aitken in his small work, distinguished by the quaint title of "The Potato Rescued from Disease."

Experimental Farm.—In expressing our notions of what an experimental farm should be, in vol. vii. p. 538, we purposely avoided connecting it with the patronage of the Highland Society; for, if we could shew, that an experimental farm, to be useful and influential, should be conducted in a manner similar to an ordinary farm, and consequently must occupy a large space of ground, it would follow that the Highland Society, constituted as it is, could not undertake the risk of conducting such an establishment. Such a farm would doubtless be best conducted by a Society formed for the express purpose, and were men of wealth associated for the purpose, it would matter little to them whether such a farm would yield pecuniary profit or not. The method we took to shew was before experiments could present their results to farmers with the force of high commendation, they must have been conducted in a manner applicable to the circumstances of a farm. If for instance any remarkable results regarding the prolificacy or other good quality of a new plant, were shewn to a farmer, as produced by the agency of the spade in a small garden, he would not disbelieve the fact, but having no accompanying security that the same results would be obtained on his own farm by the agency of the plough, he would nevertheless doubt the applicability of the process to his own circumstances. On the other hand, if the results had been produced on an ordinary farm, such as the case of Hunter's wheat or Hopetoun oats, or on a great experimental farm by the ordinary means of a farm, or in any manner analogous to it, then his anxiety would instantly be roused to obtain the advantage for himself. Is this a natural picture of the feelings of the farmer in such circumstances, or it is not? If it is, how can "results prove as satisfactory" on a small experimental farm, whose departmental operations must be performed by the spade, as on that of the "most extended scale," where the plough can work with freedom? But if not, how happens it that "the feeble influence of individual example," such as that of Mr Hunter or Mr Shireff, had the power "over the minds of agriculturists" to induce them to betake themselves at once to the cultivation of Hunter's wheat and Hopetoun oats? Moreover, if "there exists as great a dissimilarity between experimental and ordinary gardens, as could by possibility exist between an experimental and ordinary farm," how is it, that the cultivation of the necessarily numerous

and consequently small compartments in a small experimental farm, must be confined to the use of the spade, whilst the divisions of a large experimental farm would be worked by the plough, and whilst experimental and ordinary gardens are both cultivated by the spade? If the analogy betwixt the latter is exactly similar to that between experimental and ordinary farms, then experimental farms should be cultivated by the plough as ordinary farms. Again, if it is "frivolous" on our part to recommend and support the necessity of fencing the fields of an experimental farm, how can "*movable* iron fences" afford *shelter* to stock and crops,—the most essential property by far of every well regulated fence? Farther, if it be "admitted" that "benefits would be in proportion to the extent necessary for the various experiments" in an experimental farm, then it follows that a large space is "necessary for the various experiments" in an experimental farm; for these "various experiments" are not to be confined to the raising of varieties of seeds and roots only, but also to the rearing of cattle, sheep, and horses, and the feeding of cattle in "hemmels" and otherwise, and the prosecution of "crosses" among the many varieties of cattle and sheep in their respective classes. Will an experimental "farm of infinitely less magnitude than that condescended on by us," afford room for all these and many other "various experiments?" If so, the farmers on their farms, gardeners in their gardens, and even cottars in their small patches of land, may pursue each their own experiments as satisfactorily, as similar experiments can be pursued, in an experimental farm of "infinitely less magnitude" than the one we have recommended. If this is a necessary consequence, the paramount utility of a small experimental farm over isolated exertions may be questioned on very tenable grounds. But we are perhaps "grappling with the subject in a theoretical" spirit. Did he who, "casting in the shade for a time the various difficulties as to the working of such a farm," grapple with the subject more practically than we who endeavoured to discover the relative bearings of those "minor points" which must all be anticipated and settled before such a farm can ever be begun to be operated on? Whether is he, who desires "the foundation of an establishment, having for its object the

propagation of seeds and rearing of stock on a more circumscribed scale," struggling harder "to create in the minds of others a distaste for such an institution," than we who desire for the establishment of an experimental farm of such magnitude and importance as would induce either men of property or the government to become the patrons of it, and whose proceedings would eclipse all similar establishments on the continent. A small experimental farm would present no inducement to either of those classes of patrons to connect themselves with it, and should they decline it, there is no other species of patronage under which such an institution could be fostered, for the Highland and Agricultural Society, as we have before stated, would not be permitted by its charter to encounter such a risk. We have only to observe the terms in which Colonel Le Couteur recommends the establishment of an experimental farm in the neighbourhood of London, to the Central Agricultural Society, to be convinced with how little regard to practical appliances some people support their sanguine notions. On the method of filling the establishment which he recommends to be instituted as a practical school with students, he says, at p. 119 of his work on wheat, "There are 111 counties in the United Kingdom; but suppose that only 100 of them sent a student to an experimental farm—say of 200 acres." Only conceive 100 young men learning farming on a 200 acres farm, under "a few practical paid labourers and servants attached to the farm, to instruct the students in the manual operations of husbandry" (p. 111.) What a jostling and hubbub would attend every operation! The operations are to be carried on in this scale:—"Half an acre of Swedes, manured with soot; ditto, with lime; ditto, with sea-weed ashes; ditto, with salt; ditto, with decomposed manure; ditto, with bone-dust. Similar experiments to be made on wheat, barley, potatoes, and on all the staple crops of the country. The unknown or new crops, to be tried on a much smaller scale;" the Colonel enumerating "seventy-two sorts of winter wheat, and thirty-one of spring wheat" (p. 114). Where is room to be found for these experiments, on even the "much smaller scale," on 200 acres? But, besides these, "experiments might also be carried on for the improvement of stock by crosses with foreign animals, either cattle, sheep, or poultry, through the

favour, and with the assistance, of the Zoological Societies" (p. 120), the rotation of the farm being "on a four course shift" (p. 119), that is, all the rearing of cattle, sheep, pigs, and poultry, and their improvement by crosses with foreign animals, are to be supported on fifty acres of grass! After this we shall, no doubt, be informed, that our "objections" to Colonel Le Couteur's arrangements are "frivolous," and unworthy of notice, because they only embrace "minor points." Be they "frivolous" or otherwise, there is no utility in asserting abstract principles on a subject which must be instituted and pursued with attention to the minutest details. Our notions are no creations of the "fancy," but the sober testimony of experience derived from long acquaintance with farming minutiæ. If their tendency should happen to "strengthen Professor Low's objections against Mr Lewis's important suggestions," the circumstance must be regarded as an accidental coincidence; for we neither heard nor read the speech which contained the objections. Our arguments, therefore, were not advanced with the view of "raising up many barriers which are vainly imagined would strengthen Professor Low's objections against Mr Lewis's important suggestions;" and we purposely avoided any criticism on Mr Lewis's particular plan or plans, "until," as we stated at p. 546, "this point, the size of the experimental farm, were settled;" for, unless an experimental farm were instituted on a scale coinciding with the operations of a farm, we conceived it would render small service to practical husbandry or to farmers. Although we still retain this opinion, we yield in desire to no man for the establishment of a spacious experimental farm, capable, within its own bounds, of conducting experiments in every department of husbandry on such an extended scale, as their undoubted results would be hailed by farmers with unbounded confidence, however unfairly our words may again be misrepresented into the unfounded charge, of being "determined to bias the minds of the agriculturists of Scotland, against the introduction of an establishment which would be productive of consequences the most beneficial that have ever been submitted to them." To this charge we reply, in the words of maligned royalty, *Honi soit qui mal y pense.*

Kyan's process for the prevention of Dry-rot in Timber.—Until the privileges of the patent granted to this invaluable discovery were secured by act of Parliament to a company, its excellence made little impression on the proprietors of wooded properties. The company, aware that no conviction inspires confidence like that derived from reference to facts, has never ceased, since its formation, to adduce the most authenticated facts in favour of the efficacy of this simple process. Like every great practical improvement, it is now, slowly it is true, but not less securely, establishing itself in public confidence. The whole process, we believe, consists simply of steeping timber in a solution of corrosive sublimate, the *bichloride of mercury*. Mr Kyan, in claiming credit for this process, does not pretend to the discovery of any new principle; it is only in the application of a known principle to practical purposes that his claim consists. It was well known before that a solution of corrosive sublimate was commonly used for the preservation of cases of morbid diseases in anatomical preparations, and even that the delicate texture of the brain was preserved in a firm state by it; but it was never known, or even conjectured, until Mr Kyan published the fact, that it would also preserve timber from decay, that it would prevent that internal decomposition in timber, which terminates in what is commonly termed dry-rot, a term quite descriptive of the effect of the disease.

For many years Mr Kyan endeavoured to impress on the Admiralty the importance of his discovery in preserving the timber intended to be used in ship-building, but to no purpose. It is no wonder so simple a process did not at once obtain credence of its efficacy. At length, however, so many facts of its efficacy in preserving isolated pieces of timber from destruction in unfavourable circumstances were adduced by Mr Kyan to architects and others, that a parliamentary inquiry was instituted, and the evidence published. Sir Robert Smirke, among other eminent architects and timber-merchants, who were examined, stated before the Committee, that he had taken a cut from a log of Canadian yellow pine, poplar, and Scotch fir, after being prepared in Kyan's process, and put them in cess-pools and common sewers for six months, in hotbed compost-frames for other six

months, in flower-borders for the succeeding six months, and had them watered along with the flowers, and in damp cellars, excluded from the air for the last six months, but contrive all he could, he could not rot them. Every one is aware these soft species of timber, unprepared, would have rotted under such treatment in a very short time. This evidence, however, leaves the question unanswered, whether it is necessary, in the first instance, to season the timber thoroughly before the process will preserve it from dry-rot. If the utility of the process were even confined to seasoned timber, it would still be a valuable discovery, for the ships of the navy that were affected with dry-rot were all built of seasoned timber of at least three years' exposure to the air; but before the timber is considered seasoned, only conceive the destruction occasioned by the dry-rot. During an inspection which took place in Deptford yard, in the months of October, November, and December 1801, to ascertain the quantity of defective timber after the lot had been seasoned, it was found that out of 870 trees of sided timber, containing 611 loads of 50 cubic feet each, 239 trees containing 169 loads were defective. In Deptford, in October, November, and December 1803, out of 138 trees, containing 114 loads, 74 trees containing 60 loads were found defective. Again, in Deptford in April, May, and June 1805, out of 230 trees, containing 268 loads, 65 trees containing 99 loads were found defective. And in Plymouth yard, on January 20, 1806, 636 trees, containing 990 loads, were found to be defective. It may be safely asserted, that at least one-third of the sided trees which are put past to season in the navy dock-yards become unfit for the building of ships in the course of three years. The national loss in this item of public expenditure must therefore be considerable, especially when we bear in mind that a first rate man of war of 120 guns requires 5880 loads of timber to build her; a 74, 3600 loads, and a 28 gun frigate 963 loads. Now, Kyan's process as well seasons timber in a short time, as preserves it when seasoned, from dry rot, as will be seen from this testimony of Mr George Ward, Dorset Street, Salisbury Square, London, joiner, who cut a piece out of a log of Hispaniola mahogany, on 9th March 1833, sent it to be steeped on 12th April, and used it in a wrythed hand-rail on 21st June of the same year. He cut another piece out of a log of the same kind of mahogany on

25th March 1833, sent it to be steeped on 4th June, and used it in a clampt flap and frame on 30th August of the same year. On 5th July 1834, he says, "In neither of the above instances has there been the least shrinking of the wood since it has been used, nor has the colour of the mahogany been at all injured by the process." It must be owned no severer trial for warping could unseasoned timber be subjected to, than in hand-railing and clampt-framing. We observe in this city that many cabinet-makers, rather than place their capital in a dormant state by storing up timber to be seasoned, send it to Kyan's tank to be steeped and seasoned just as they require it.

The ravages of the dry-rot among the ships of the navy are fearful. Independently of the enormous cost for repairs which this disease causes to be incurred to the nation, the jeopardy which men's lives are placed at sea in ships in a state of dry-rot is worthy of the nation's consideration. It is not uncustomary for vessels to cruise on foreign stations for three years, and yet many of the ships of the navy have been obliged to be docked for repairs in a shorter time than that after they have been prepared for sea. Out of twenty-three seventy-fours, only nine exceeded three years before they were obliged to be docked for repairs after being built. The Ajax, seventy-four, was only five months at sea after being finished in 1798. The l'Achille, one year five months; and six others not exceeding two years. The Kent was longest in being docked, being seven years one month at sea. The average of the whole number did not exceed three years five months. But it is not the loss of service alone of such valuable ships when in dock that is most to be deplored, the pecuniary loss arising from repairs, entirely occasioned by the ravages of the dry-rot, is of greater importance. The hull of the Ajax cost in building L. 39,039, and, after she had only been five months at sea, the repairs for dry-rot cost L. 26,683. The six ships that had only served two years at sea cost in building their hulls in 1810, 1811, 1812, and 1813, L.349,974, and afterwards in repairs for dry-rot L. 297,368. Eighteen frigates, rating from twenty-four to thirty-six guns, cost in repairs in 1805 L. 253,148, 17s. 5d., and, if they had been built anew, would only have cost L. 150,208, 15s., being in the proportion of three for building, and five for repairs. But the case of the Victory we shall

particularize as a ship that can never cease to excite public interest. The building of a 120 gun ship during the war, according to Edye's calculations, cost L. 97,400. In the very first year, 1800, the Victory, 100 guns, was repaired in Chatham, and her repairs did not terminate until 1803, until after they had cost L. 96,020. This was before the battle of Trafalgar in 1805. But in 1814, 1815, and 1816, she was again repaired at Portsmouth at the cost of L. 47,558. So that she has altogether cost for repairs L. 143,578 in fifteen years. But all these are isolated instances. The total sum for repairs for the whole navy cut a conspicuous figure. From 1800 to 1820, over and above the ordinary repairs of wear and tear, which were L.6,412,592, the repairs cost L.11,037,183, being an annual average of L.551,859. The greater part of this period was in the time of war, but even in time of peace the dry-rot appears to have made as great ravages, for from 1822 to 1832 the cost for all repairs amounted to L.7,971,852 : 7 : 4, being an annual average of nearly L. 800,000, which was about the war average. As the usual wear and tear should be much greater in war than in peace, it follows that the dry-rot is committing greater ravages now than in the war. That beautiful ship the Vernon, 56, has been seized with this hurtful disease, and must, of course, go into dock at an enormous cost for repairs.

These facts call loudly for the adoption of some means for the prevention of so raging a malady. Many expedients, we believe, have been attempted by the Admiralty to assuage the evil, and tests have been used to ascertain the soundness of timber by immersing it in fungus-pits, but all have failed. Now, however, that Kyan's process has been proved to be efficacious in preventing this dire disease, the Admiralty ought to make a trial at least of one ship so prepared. Much money would no doubt be saved to the public by its adoption. What with extraordinary repairs, and building and ordinary repairs, the annual expenditure for timber in the navy-docks during the war was about two millions, one half of which might have been saved by the adoption of this process. But besides the prevention of dry-rot in ships, the stock of timber kept for seasoning may be dispensed with, besides the saving in repair of public works, such as docks, buildings, &c.

Important as Kyan's discovery is, in a national point of view,

in regard to the navy, it is also important, in a national view, to the landed interest. If by this process proprietors of wooded estates can not only use the timber they grow in buildings, fences, implements, and for all country purposes, but dispose of it to others who have no wood fit for use, a stimulus will be given to planting which will soon clothe the waste places of the country with growing timber, and in time render the agricultural interest entirely independent of foreign timber. Indeed, it is proper to be prepared for such an event, for the settlement of the Canadas by emigration will in time so denude them of their magnificent forests, that no timber will then be available for exportation to this country. The value of this process is not confined to hard timber, it seasons sap-wood in as short a time, and preserves it also from decay. This property of it will have the effect of increasing largely the quantity of useful timber. If a tree, for instance, which may be squared to thirteen inches of heart timber, can be squared to sixteen inches including the sap wood, its value as a marketable commodity will, by this process, be greatly enhanced, much timber being thus rendered serviceable which would otherwise be wasted. The applicability of home timber to every purpose of building, fencing, and implements, would insure a great saving to the landed interest. That this process renders wood for any species of work durable, may be shewn from the testimony of many credible witnesses. Two pieces of the same wood and from the same part of the wood, the one prepared the other not, were put into a pit in Westminster where a great deal of rotting was going on; that piece which had undergone no preparation became pulverulent and crumbled down under the pressure of the fingers, the other, both being sapwood, became like heart-wood, and manifested no tendency to crumble, though it had been cut with a knife. Captain Alderson of the Royal Engineers made some experiments in the Royal Carriage Office, Woolwich, to ascertain the effect of the process upon timber used in the construction of gun-carriages. He obtained pieces of oak, ash, and elm quite green, with the bark on and twigs with leaves upon them. Half of the pieces were steeped in the solution, and the whole of them put into the fungus pit to rot in March 1835. They were taken out in September 1836, when the unprepared were quite rotten, and the other, even to the preservation of the

bark, sapwood, and leaves, were perfectly sound. The spokes, felloes, and shafts of carts and carriages could thus be rendered durable for an indefinite length of time. Sir Robert Smirke put a couple of posts under a dropping eave, and both were exposed to the same actions. After a certain time the unprepared decayed, the other still stands. He also put up a considerable quantity of paling about three years before he gave his evidence on this subject before the Committee of the House of Commons, when it was in quite as good a state as at first, though it was partly in the ground; whereas, some paling which he had put up the year before, not fixed into the ground, but close upon it, unsteeped, was obliged to have its lower part cut away in three years. The fencing of plantations, young hedges, and the preservation of hurdles, field-gates, watering troughs, thus may be almost permanently insured.

The sleepers used for railways may be used by this process with advantage instead of stone, and to all who have ever travelled on a railway laid on wood, it is obviously a much pleasanter motion than on stone. Now that the rage for railways prevails, the supply of timber in any part of the country through which the railway passes, will render its construction more economical. Pieces of green larch were used as sleepers on the Southampton railway; some of them having cracks wide enough to admit a penny piece. After being steeped they became compact, and the cut diameter which had been flat became curved, and the pieces more fit for the purpose they were intended.

The yearly destruction of poles in the hop grounds in England is very considerable. They have to be renewed every six years, besides being repaired every year. When steeped they will last thirty years, barring breakage. The annual expense of maintaining and repairing these poles is estimated at L.10 an acre, so that by using this process the hop grower might supply himself with poles at one-fifth of the present cost.

It is equally efficacious in preserving flooring. Messrs Harris and Warner, hatters, Southwark London, laid a piece of flooring partly prepared. In three years the unprepared part entirely gave way, whilst the other remained as fresh as the day it was laid down.

The process is a protection against the attacks of insects, both terrene and aquatic. A naturalist who has long been in the habit of collecting insects on old rails, cannot now find them lodged on any that have been subjected to the process. The piles used in jetties and dock gates, are effectually protected from the attacks of marine animals. We have seen two pieces of elm which had been cut out of the same log, and placed under water at the Trinity Chain Pier near Newhaven; after being a twelvemonth immersed, they were both taken up covered with young mussels. The prepared was quite fresh and sharp at the angles, whilst the other was decayed or rather eaten away at the angles and ends.

The commercial navy have taken advantage of the process. The ships Enderby and John Palmer of London were built of prepared timber, and both are South Sea Whalers. The Enderby sailed from London on 11th October 1834, and returned to Gravesend on 7th March 1837, having been absent twenty-nine months. She fished about the Equator, and although much subjected to a tropical and vertical sun, her seams remained entire. The John Palmer was away for three years and a-half, and came home equally tight. The bilge water in both cases was much sweeter and freer from noxious effluvia than usual. Apprehension was expressed about the healthiness of the crew of a ship that had been built of timber prepared in mercury. A similar dread prevented Sir H. Davy and Professor Faraday urging the employment of corrosive sublimate as a means of preventing the ravages of the book-worm in Earl Spenser's library at Althorp. These apprehensions may have arisen from a recollection of the well known circumstance of violent and even fatal salivation affecting the sailors on board H. M. S. Triumph in 1810, from the rupture of bladders of quicksilver, and the escape of it about the ship. But they may all be dissipated by the testimony of Captain Lisle of the Enderby, who declares no crew could have been more healthy than his was all the time she was at sea.

But the process has the power of preserving cordage and canvass as well as timber. Colonel Sir John May, Inspector of the Royal Carriage Department at Woolwich, subjected to the same trial pieces of prepared cordage of five inches, with a duplicate piece of white unprepared cordage, also of two and a-half inches, one and a quarter inch, and pieces of tent line. The prepared

pieces were quite sound, the unprepared quite rotten. Cart ropes, reins, and sheep nets may thus be preserved in use a long time. Sir John also subjected four pieces of canvass prepared which were not at all affected with mildew, whereas those pieces unprepared were affected, and one became quite rotten. Captain Farquharson of the Lord Hungerford of London, on his return from a voyage to the East Indies in June 1836, found an awning of canvass which was unprepared quite mildewed, whereas one of the same kind of cloth prepared was perfectly sound and clean. Thus barn sheets, cart covers, sacks, and windmill sails may be preserved from destruction by this process.

What need of adducing more evidence on the efficacy of this process for preserving animal and vegetable fibre? Let us rather investigate the principle of the process and recommend the adoption of it to those who have hitherto neglected to take advantage of its utility. Dry-rot in timber is frequently distinguished by a sort of mildew which covers it, and the action of which in time causes decay, or it assumes a less organized appearance and crumbles down into powder. This mildew is not the dry-rot, nor the cause of it, but rather its effect. It may be distinctly seen by the microscope to be a fungus, and springing up where it does, it becomes a question whence its germs can have found access into the wood. To assist in answering this natural query, we may state that Mr Bauer, when treating of the pepper-brand, *Uredo fœtida*, states that fungus to be of a globular form and of the size of only $\frac{1}{1600}$ part of an inch in diameter, and therefore no less than 2,560,000 would be required to cover a square inch. The germs of such plants must therefore be infinitely minute. Professor Ehrenberg, also, when treating of the Monas and others of the Infusoriæ, states, that in the twelfth part of an inch there are 28,000, and in a square inch not less than 500,000,000. It is, therefore, extremely probable minute vegetable germs may be introduced through the spongioles of the roots of plants. Indeed Unger detected the existence of such bodies in the stem of *Galium Mollugo*, which he has termed the *Protomyces endogenus*, developed in the coagulated juice of the intercellular spaces. All plants, as is known, are composed of cellular tissues, whether in the bark, albumen, or wood. The tissue consists of various shaped cells, and although no single

cell may pass along the whole length of the plant, as M. de Candolle maintains, yet there is no doubt water, air, or even mercury, can be made to pass through those cells in the longitudinal direction of the fibres of wood. Experiments with the air-pump have proved this passage beyond doubt. These cells contain the sap of the plant, particularly those of the alburnum, and in the circulation of the sap through the tree its watery particles fly off by the leaves, and the albumen remains. Albumen is the nearest approach in vegetables to animal matter, and is therefore, when deprived of vitality, very liable to decomposition, particularly when in the alburnum or sap-wood. On minutely inspecting wood going to decay, Mr Kyan was impressed with the conviction that decomposition of the sap in the alburnum gave rise either to the dry-rot, or, by the evolution of heat, vivified the germs of the fungi that may have been lying dormant in the cells of the alburnum. Now, as corrosive sublimate was known to preserve animal matter from decomposition, so might it preserve albumen. The experiments which he performed on albuminous and saccharine solutions with corrosive-sublimate, confirmed the correctness of his conjectures. But the prior experiments of Fourcroy, and especially of Berzelius, in 1813, had produced the same chemical results, although the latter had not discovered their practical applicability to preserving wood. Berzelius found the addition of *bichloride* of mercury to an albuminous solution to produce a *protochloride* (calomel), and the protochloride combined with the albumen, and produced an insoluble precipitate. The insoluble precipitate hardens like a fibre, and fills up the open cells. This is the chemical principle of the process. The intention of seasoning timber by exposure to the air, is to dry up the albumen before it begins to decompose naturally; but that the seasoning is not always successful, may be ascertained from the defective state, already alluded to, of so large a proportion of the timber in the naval dock-yards. We may now see how green wood may be seasoned at once by the process, in that there is a larger proportion in it of albumen for the sublimate to act upon. The process is somewhat analogous to tanning leather, the tannin principle of the bark combining with the animal jelly of the skins, and forming an insoluble precipitate. Oak contains much of the tannin principle; and, as the sublimate

does not act upon it, oak, of all woods, least changes the sublimate solution. The process thus resting on simple chemical bases, its efficacy can never be neutralised. Nor can deception be practised by those who intend to deceive the unwary. A chemical reagent exists, by which the wood can be tested that has been properly steeped. A drop of hydro-sulphuret of ammonia will make a black mark on wood steeped in corrosive sublimate, whereas it will produce no change on common timber.

We are glad to be informed that thirty-five tanks of Kyan's solution have been erected by noblemen and gentlemen in Scotland, upwards of sixty in England, and a few in Ireland, for the purpose of serving their own estates. Tanks are now to be found in all the principal maritime ports in the kingdom. Shipwrights and joiners do not relish the process, in the apprehension their services may be less required, but owners of ships and proprietors of houses will, nevertheless, use it for their own sakes; and we have no doubt, ere long, shipwrights and builders will be unable to dispose of new ships and houses, unless they have been constructed of timber subjected to the process.

With regard to the expense of the process, which is a material consideration to those who use large quantities of timber, a builder, whether of ships or houses, pays for steeping *one pound* sterling per load of fifty cubic feet. Gentlemen taking out private licenses for their own estates, and not for the purposes of trade, pay *five shillings* per cubic foot of the internal area of the tank erected, for the use of the invention during the whole term of the patent. Licenses for trade are given on the principle of receiving a small *pro rata* proportion of the profits of the license. Exclusive licenses in towns are only granted to those who qualify as shareholders, in order to secure their zeal for promoting the interests of the Company.

Progress of Agriculture, and advantages of Agricultural Education. By Mr W. G. Fearnside.—In the agriculture of the United Kingdom great changes are in silent progress taking place, advancing so deliberately and slowly, that until nearly towards completion or entirely effected, the results do not become generally apparent or openly acknow-

ledged. At present Ireland supplies England with live and dead stock, as well as corn to a considerable extent; but while under every possible vicissitude in the corn laws, the one will, for a long period to come, be a granary to the other, we are no less convinced, that Ireland, at no very remote period, will cease in a great degree from being a grazing country. In Ulster the pressure of population has forced tillage to the tops of the mountains; the same cause which is in operation throughout the island, will produce similar results in districts where grazing is more extensively followed. In the western and southern counties cultivation is spreading rapidly into the bogs, and up the sides of steep and craggy hills, and even making inroads on the most favourite and fertile pastures. Besides, in Ireland, as long as the supply of labour so much exceeds the demand, the cultivation of the ground, under any circumstances, will be to a certain degree preferable; but in England the cost of labour, being much heavier than in Ireland, added to other local burdens, has made farming in many places, even at nominal rents, a losing trade, and the land has been suffered to revert to its primitive state. In addition to which, the numerous steam-vessels now plying along the coasts afford such facilities for conveying fat cattle and sheep to the best markets without any sensible falling off in condition, as to have induced both English and Scotch farmers to turn their attention to the rearing and fattening of stock to a greater extent than at any former period; so that we have good reason for believing, that the demand for Irish stock will be diminished, while that of grain will be more than proportionately increased. It ought also to be taken into the consideration, that no loss attends the conveyance of grain to a distant market, and that the cost, especially if it be in a manufactured state, is much less than that of conveying cattle. We feel confident that the transition contemplated, and which, both an external force operating on the landlords and their own direct interest concurring to bring about, will, in a pecuniary point of view, be of advantage to the sister island, and with the meditated Government measure of affording relief to her poor, will tend materially in ameliorating its social state, while, at the same time, it ought to impress the Irish with a deep sense of the *national importance of agriculture*, and the paramount necessity of rendering every facility to

its improvement and advancement, of which the soil is so pre-eminently susceptible. A new era from another cause is also opening a happy career for our Irish brethren in the formation of societies and the spirited exertions of talented individuals, among whom Mr Dimsdale occupies a prominent station, in applying the full power of their mind and energies in surmounting difficulties and obstacles, political and personal, as well as natural, apparently almost insuperable, in order to reclaim immense tracts of this fertile portion of her Majesty's dominions. A few years can now only elapse before vast tracts of land, of the richest soil, will be rendered available to the growers of flax and grain. Many morasses are capable of drainage; and it is proved that capital, as perseverance is not wanting, is alone required to recover, from the encroachments of the sea and rivers, large districts of alluvial soil, ready to yield a rich return as soon as it is freed from the watery element. With the progress of such events, and the enlightenment of the human mind, the most beneficial changes must be wrought in a country so capable of agricultural improvement; and when the people receive wages for their labour sufficient for livelihood, they will speedily afterwards become more sensible of the great advantages resulting from industrious, independent, and peaceable habits. In England, when the country is intersected with railroads, a great revolution will be effected in our social intercourse and agricultural interests. The most distant counties will be made to approximate each other, and brought into intimate contact with the large market towns; the various systems of tillage and products become familiarized in different counties; the interchange of produce established, and prices equalized, of commodities hitherto almost unknown as common articles of sale; consumers and producers deriving an inestimable benefit from a mutual easy access; all agricultural produce is likely to be raised in value from its more general diffusion; and the price of land in more distant parts, owing to its removal from ports or market towns, considerably enhanced, while it will have the effect of reducing the value of the necessaries of life in the places of consumption. These are the changes which are being worked in the agricultural character of the kingdom, and which will create radical conversions in the relative position of rural affairs, causing

some districts to become gradually grazing communities, while in others grain will be supplanting pasturage. Another and more beneficial action has been also in operation—the improvement intellectually in the cultivators of the soil, and the natural results have been, a better system of husbandry, and more abundant returns. A few, very few years since, one of the most theoretical men under government, M. Jacobs, who had every facility afforded him of gleaning knowledge from the statistics not only of England, but the whole corn-growing countries of the world, affirmed before a Committee of the House of Commons, that England could not produce sufficient corn for its augmenting population, and that annually a deficit must occur of at least *one-ninth* of the whole consumption, so that annually a foreign importation of wheat would be indispensable; but the effect of advanced science and favourable seasons have controverted all theory, and enabled the nation to approach the fifth harvest without requiring foreign aid. It is true, within these few weeks we have had about 200,000 quarters of the finer qualities of Danzig, Lower Baltic, and Elbe wheats, liberated from bond, merely, however, from the want of dry and fine old wheats to mix with the new growth, which, from its condition, was unfit for immediate grinding purposes; the high duties paid, the highest ever received by the Exchequer, viz. 29s. 8d., 30s. 8d., and 31s. 8d. per quarter, affording a convincing proof it was not dearth of food, but circumstances arising from an incidental and peculiar occurrence, which induced holders to free their grain, with the little probability existing of a lower range of duties prevailing.

The ultimately magic effect is still left, however, to be created from an ameliorated system of education, when the mind is expanded and enlightened, by early tuition in the elements of the profession which it is intended for the youth to follow, making him practically and theoretically an agriculturist either as labourer or master, and enabling him, by science, to appreciate the fertile resources the earth is capable of naturally affording, or being made capable of yielding,—then will the barns not only likely teem with abundance, like another golden age; but, to a certain degree, even the seasons will, in all probability, be improved throughout our isles, especially Ire-

land, where, by an extended system of drainage, and converting bogs and marshes into arable land, and reclaiming lands now submerged in water, the accumulation of vapour will be considerably diminished, and less vicissitude of clime likely to be experienced. This is, however, a speculative subject, which, physically, would lead to too lengthened a dissertation at present to work out; but, from natural causes, such a result would most likely ensue. All, however, who have the good of the country at heart—who are sincere patriots—ought to dedicate their earnest attention to the improvement of the agriculture of the kingdom, possessing, as we do within ourselves, not only the means, if properly developed, of finding our own subsistence, even for the rapidly increasing population, but feeding also our colonies, and vieing with America in exporting food to distant parts of the New World. These capabilities are still neglected, this mine of wealth still unexplored; and though much is being attempted, yet it is melancholy to reflect how much more good might be wrought with perseverance and application well directed. We are firm in the conviction, that it is by an improved system of education, by enlightening the prejudices still too prevalent, and enlarging the sphere of acquirements, that the rich resources now lying latent in the earth can be developed. The farmer in retired parts of the country has no opportunity of availing himself of the advantages derived from mixed society, or of extending his views and ideas from new topics of conversation presented to his attention. But, from the elementary principles of his profession imbibed during his growth, the germ would have been implanted, which, as he pursues his daily occupations amidst " Nature's walks," would be rapidly attaining strength and nourishment,—yielding in its growth constant materials of interest and attraction, either by affording the means of corroborating or controverting pre-formed theoretical opinions, which would gradually induce reflection, expanding the mental faculties and capabilities, and thus, possessing within himself those desirable resources of intelligence and information which he, in after life, seeks for in vain,—constituting him a *thinking being*, making him a bright example of the high prerogative man enjoys, and which exalts him above all other grades of animated nature. Do we not witness in Scotland illustrious and

bright examples of the effects of education? Look at the eminent and moral standard of the people compared with the English or Irish. Mark the metamorphosed state of the country during the last century, or even half that period. Low marshy lands have been drained and transformed from swamps and wastes clad with rank grass and rushes, into fine luxuriant meadows, while the higher grounds have been cleared of their whin bushes and decked and sheltered with plantations, and either brought under the plough or rendered valuable for sheep pasture. The work of draining, clearing, ploughing, manuring, and dressing, the land, in every way which experience and skill can suggest, has ultimately had the effect of yielding a bounteous return, and the best caltivated fields which produced only three-times the amount of the seed sown, now return eight-fold the amonnt.

Royal National Stud.—The royal stud, after all that was said to prevent it, has been brought to the hammer and dispersed. Every one who has the least regard for the horse, the noblest of all domesticated creatures, must regret the abolition of a royal stud. In England especially, where the breeding and possession of blood-horses confers distinction, and is pursued and gloried in by the highest nobleman and wealthiest commoner, a valuable stud is a befitting appendage to the royal establishment. It forms the nucleus around which all other racing establishments can rally; the spring from which all others may be refreshed; the pattern by which all others should be guided. To possess such an influence, the stud ought to be a national establishment, national as patronised and fostered by the crown, the source of all honour and high bearing, and not by annual votes of Parliament, subject to be nibbled and grumbled at by every ascetic patriot, whose domicil shuns the light of day. Much exertion has been bestowed in establishing a national gallery in which all the works of taste and art, belonging to the nation, may be collected and exhibited for the enlightenment and refinement of the public mind and taste, and very properly. Let as zealous a spirit be exhibited in the establishment of a national stud of every description of horses, suited for every variety of work which the genius of the nation can call forth. Of the two national esta-

blishments, we would lay any odds, the stud would excite the more general interest, in as far as the sight of a living, buoyant, blooming, graceful horse, is infinitely superior to any portrait that can be painted. And will not the public mind be enlightened by observing the habits of God's noblest creatures, and the public taste refined by contemplating beauty in the fairest living models? These need not, however, be rival establishments, farther than for the public estimation, for both the National Gallery and Royal Stud were instituted by the same munificent patron. Although the old stud was instituted on an objectionable footing, it was a noble act in George IV. to attempt to rescue, through his own private resources, the abstraction of the best blood from the country; and, as much as any individual could, he strove to lay a foundation for retaining that blood upon which a stud that would have reflected honour on the nation, might have been formed. But circumstances ruled it otherwise, and his disinterested and patriotic designs in this instance were frustrated. We own our disappointment at the small sum realized for the stud; 43 *good* brood blood mares ought of themselves to have fetched more than L.17,000, besides the stallions and Arabs. The circumstances under which the sale was introduced to public notice were probably unfavourable for bidders; besides the base attempts of a certain portion of the public press to depreciate the value of the stock, could not fail to engender prejudice against it. Many who attended the sale might perhaps have been purchasers, but for the uncertainty of how ministers intended to act for the crown. As to the termination of the whole matter, it was a disgraceful affair.

Prices of Live Stock in Upper Canada.—It must be a curious sight to witness the colonization of a new and almost uninhabited country by emigration from an old. Many an alteration must be witnessed in the new which could not happen in the old country. How strange must the placid, the smooth, and half-indolent short-horn appear on the borders of the bush, or in the midst of forest glades, where one would expect to meet none but the fiercest of creatures, with shaggy coats, glancing eyes, scowling aspects, and long sharp-pointed horns, ready to impale you on the horn of either dilemma. The Leicester, one would never

dream of finding among blackened stumps, or indeed near a forest of any kind. In the old country, land must have been drained, fenced, sheltered, and long brought in and cultivated, before we would ever think of rearing a stock of short-horns or a flock of Leicesters. And yet, among our transatlantic brethren of the soil, these docile creatures are reared amidst the gloom of the forest and the roughness of a clearance, and seem to thrive withal, if we may judge by the prices which they realize.

In the Hamilton Gazette of 18th October last, we observe an account of a general cattle show of the Gore District Agricultural Society, held at Dundas on 11th October. Every species of breeding stock were exhibited, comprising draught stallions, entire colts, mares, and fillies, bulls, cows, and heifers, rams, ewes, and lambs, and boars and sows; and also yokes of oxen. Perceiving so high a number as sixty-six attached to one of the premium stock, we presume the number brought forward altogether must have been considerable, and it intimates pretty broadly that the district must now be well supplied with live stock. The premiums vary from ten dollars of 4s. each for the best draught stallion, to two dollars for the second best sow. Amongst the list of competitors the name of our friend, Mr Adam Fergusson stands conspicuous, gaining five premiums out of twenty-four, from amongst fourteen competitors, the stock being short-horns, of which we know he had imported a number at the outset of his settlement in Canada. A Mr Joseph Ireland exhibited Leicester tups and ewes, and also a ram of the native breed. We would advise Mr Ireland to make mutton hams of his native rams, although we never saw the breed, and cross the native ewes with the Leicester tups, and the cross will repay his trouble and risk much better than the pure natives, and if the pure Leicesters thrive with him, which they must do else he would not have produced them in competition, or exhibited them at all, the cross cannot fail to succeed. The South Downs we would consider a valuable breed of sheep for Canada in its present transition state, they being, hardy, good feeders, yielding fine mutton, and casting a short valuable fleece, less likely to be injured than the long staple of the Leicester.

Mr Ferguson sold some of his breeding stock on the ground at good prices, namely, Short horn Bulls—*Sir Walter*, to J. B. Ewart, of Dundas, for L.32; *Romulus*, to A. N. Macnab, Esq.

for L.21; and *Washington*, to Mr J. Watson, Woodstock, for L.28. Cows—*Dairy Spot*, to Dr Hamilton, for L.20; and *Red Star*, to the same gentleman, for L.23. Heifers—*Miss Prue*, to Mr Duff, for L.22; and *Cowslip*, to A. N. Macnab, Esq. for L.33.

On 6th October, Messrs Hoffman sold short-horn cattle, at New York, at the following prices: Bulls—*York*, 100 dollars; and *Young Duke*, 17½ dollars. Cows—*Fortune*, 160 dollars; and *Charlotte*, 120 dollars. Heifers—*Camilla*, 75 dollars; *Dahlia*, 65 dollars; and *Lilly*, 40 dollars.

From these prices realized for short-horns, it is clear they are hardy enough for the climate, and must thrive in it. Indeed, it is only people entirely ignorant of their habits and constitution that ever complain of their tenderness, for they will maintain their condition in the low country, where most other cattle would scarcely pick up a subsistence. In this respect they are like Frenchmen, who could pick up a living among Englishmen's feet.

ON SOME IMPERFECTIONS IN SCOTCH FARMING.

The farmers in Scotland have attained so much just celebrity for their management in rearing good crops in an inferior climate and soil, that some apology may be required from one who is not practically acquainted with agriculture, and yet attempts to point out where there appears still to be room for improvement. A mere theorist need not expect much attention; but it may, perhaps, be sufficient, on the present occasion, to plead that the experience derived from travels and visits to various parts of the country during harvest for many years, aided by the information and opinions of both proprietors and tenants, gives me a claim to submit the result of my observations, with a view to experiment or inquiry, especially as it is notorious that farmers as a body are not migratory, and the beneficial systems established in one district are often utterly unknown at a distance.

I have heard it remarked by an intelligent friend, that Scotch farmers are skilful in rearing good crops, but they do not seem to know what to do with them.

In this commendation I agree, with one reservation, that they have sometimes the defect of being later than necessary

Of course, my remarks are far from being universally or even generally applicable, as there are many exceptions, but those whom the cap fits are still numerous.

I trust I shall not be suspected of a wish to cast blame. My object is only that benefit may result from diffusion of information as to the better modes of proceeding in various places, and to shew what practices are proved to be erroneous.

First, with regard to *sowing*, valuable time is often lost. Some years ago I was at Logiealmond about the 3d of April, when there was the finest possible spring weather. The air was most genial and balmy. Seeing a great tract of country almost entirely ploughed, only a fragment of each farm being unprepared, but still no symptoms of sowing, I inquired the reason. I was told that they were all waiting for one another. Why? Because whoever sowed first had his crop first ready for the sparrows or crows. I pointed out the disadvantages not only of letting slip such an opportunity when the ground was in perfect order and the season so favourable, but also of having such an immense extent of crop all ready for the sickle at once,—but to rouse the spirit of martyrdom was impossible, the risk of being sparrow-feeder for the rest was quite a bugbear. If all had sown the large proportion that was ready there was no danger of loss, but by their plan they each incurred more risk than they tried to avoid.

There is also some lingering prejudice about lucky and unlucky days,—or beginning at the end of a week to a business which cannot be finished, which is often an excuse for delay,—or being too soon for the midsummer rains, as if the climate of Scotland, instead of being precarious, was like that of India with periodical monsoons, and as if rain after the longest day were as certain as the shortening of the days. People do not deny that it is beneficial to have an early harvest, but forget that that is hardly consistent with a late spring. A place is called early because the sowing, and consequently the reaping, is early, though in some cases the soil may be the efficient cause of this advantage.

Secondly, With regard to cutting; the fear of shearing too soon has often the effect of making people put off till too late. If a crop is left standing for ten days or a fortnight after it is yellow, and the question is put, Why is it not reaped? various

answers may be expected,—" It's no just ready ;" " We'll yoke to it on Monday ;" " It's no worth while now, for its but a broken week ;" " It's no lucky to tak ony thing on hand on a Friday, and it's but twa days after a', besides we hae na gotten hands eneuch." This may be from people whose own hands have been snug in their pockets, and who would not do so much as they could with what was ready. Though some of the crops are admitted to be ripe, they will not begin till they can have general harvest. Farmers seem to be a most sanguine class, notwithstanding almost annual experience to the contrary. It is too often erroneously said there is no hurry,—nothing disturbs their reliance on a continuance of good weather, upon which all their calculations seem founded. Here is the fundamental error. Their view is, What is the best mode of proceeding supposing fine weather to last ? whereas I wish it rather to be considered, What should be done in case of bad weather coming ? " There are occasions when the saving of a day may prove of vital importance to a farmer," but there is a strange miscalculation, arising from inertness of disposition, which leads them to put off the evil day of exertion, as if it was to be saved by any avoidance but the loss of the crop.

As to wheat, it is an ascertained fact that it may be cut partly green, if the ear be but full it will ripen and harden in the stook faster than on the ground. If this be true of a standing crop, how much more must it hold in cases where it is laid ? In some places in England it is cut very green, so that the name " Hertfordshire greens" is well known to signify a superior grain, and I have been told, that in Norfolk the practice was borrowed from Dunoon in Scotland, where the climate is not such as to render it prudent to neglect any expedient to avoid the possible superabundance of rain. I know I must now prepare for a unanimous exclamation, " Oh ! but the climate of England is so superior to that of Scotland." I do not pretend to deny that it is warmer, and in many places drier in summer and autumn, but the difference is not so great as between the frigid and torrid zone, or between the monsoon of India and the drought of the great desert. Have we never seen such weather as will admit of expeditious proceedings ? Do we never hear of wet weather in England when it happens to be dry in Scotland ? Does not the usual variety of the season sometimes produce the advantage

of a fine succeeding a rainy tract of weather? In this very season some farmers in Scotland got their wheat housed, while in Norfolk, Sussex, and Kent, part of it was still kept exposed in the middle of September owing to successive rains. I do not pretend to get over the insuperable disadvantage of continual wet, and those who have not watched the progress of events will treat with contempt, as uncalled for, an exhortation not to lose that gift of Providence, the opportunity of reaping in fine weather. Nevertheless, any person who has experience must have seen that the farmer, and, consequently, the scorner, is in fault.

Predestination even has something to do with it. They do not consider that, according to their own phrase, it is a tempting of Providence if they do not make the best use of a season which might have been long enough good, if diligent use had been made of it; and yet probably, if the weather failed, not only would the season be blamed, but He who made the seasons. But the great advantage is, that it gives a *choice of weather*. I do not advise cutting any crop either green or yellow, if the weather be bad, but only that it should be cut as soon as possible if the weather be good. In this way it would often happen that the harvest might be a fortnight or three weeks earlier in than it is; and if only one pursued the plan, he might have his crop housed in safety when his neighbours were tardily commencing. Mr Birkett, a great corn-factor in London, who visits Scotland to make large purchases of grain, states as the chief cause of the inferior price which Scotch wheat brings in the English market, that it is often discoloured from being so long exposed to the weather after it is ripe, and after it is cut; and the truth of his remark was accidentally tested one year in East Lothian, where a farmer cut one half of a field of wheat a fortnight sooner than usual, when all his neighbours pointed at him as "demented," and that produce fetched a higher price than the other half, or than any wheat in the county that season, because it was a fair sample.

As to barley I have little to say, as it must be ripe before it is expedient to cut it. But when, after it is yellow, it fades or becomes white or red, when it is laid, and the clover is growing through and over it, and when the pickles are falling from the stalk, all of which I have seen, such neglect must bring loss,

and they are "cheap of it." Unnecessary delay in cutting is particularly injurious, when it is the system to sow clover with it, as the longer the grass is, the longer it takes to dry for carrying.

As to oats there is great room for amendment. In East Lothian I once happened to go round a large field, apparently quite yellow, and on asking why it was not cut in such fine weather, I was told to observe that, at the bottom of the furrow, there was still some rather greenish, a mere *soupçon*—perhaps one stalk in a hundred. I said I should not like to risk the loss of the ninety-nine for the chance of adding the hundredth, and worst; and that very night there was a thunderstorm, which impressed upon me, and probably upon the lady and her grieve, that their's is not a profitable way of reckoning. If the crop ripens unequally, and a large majority of the stalks, or of the pickles, be ripe, it becomes a nice calculation what should be done. If it be laid, it must be destructive to leave it for the rain to rot it; and if it be standing there is great risk of shaking. Whenever it becomes yellow below the ear, it is advisable to cut it, as it will derive no more nourishment from the ground, and the ear, if full, will ripen and harden quicker in the stook than if connected with the moisture of the soil. That oats may be cut sooner than is the general practice, is evident from a singular instance. The farmer of Stenhouse Moor, where the Falkirk Trysts are held, is enabled to crop half the ground alternately every year, because only the last fair requires the whole extent. One year when the time came near, he was in despair; the oats were still so backward, and even meditated leaving them for the cattle to trample under foot. But he thought better of it,—cut his green grain, and afterwards acknowledged he had never had a crop that mealed so well. Lest the ear should shrink, they shrink from cutting till they lose it altogether. One might suppose they even waited for the ears to be fuller than they can hold. The top pickles are the largest, and the first ready, and by waiting for the rest, they are frequently lost, owing to their feeble adhesion to the parent stem. The fable of the dog with the piece of meat in its mouth, should not be forgotten,—nor the bird in the hand—when one considers that after the crops have

gone through the worst the winds and rain can do, they have to sustain the rough handling of the reapers with the sickle or scythe, and the harpooning, and the tossing of the pitchfork; so that the field looks afterwards as if it had been sown—it is surprising that so much is ultimately produced. If the crop be left till the straw whitens and becomes brittle, the liability to dismemberment from the weather, as well as during all this process, increases, and the straw itself loses weight and value, and is less nutritious, being "*fushionless.*" These are the consequences of giving up the driest and warmest weather. The last point is the carrying. How surprising and erroneous many farmers in Scotland must consider an English report which mentions "the cart almost following the sickle." In Scotland the excessive desire to get the crop dry, too often leads to its being soaked till it sprouts.

A singular instance is recorded of activity in Kincardineshire last year. After being long baffled with bad weather, till the season became alarmingly late, there was a prospect of more settled weather on Sunday the 23d of October. It was accordingly determined to take advantage of the moonlight, and set to work that night, a most unusual proceeding in Scotland. They never relaxed for three nights and three days till all was secured, and the day after began that storm of snow, which with little intermission continued till late in the spring, and ruined the crops in other places, where it was taken for granted that the reaction in the weather would be of sufficient continuance to serve for more leisurely proceedings.

It is worthy of remark, that in a parish in Ross-shire, the sacrament one year was fixed during harvest. As usual on such occasions, Thursday is kept as a fast-day when nothing is done; and on Saturday afternoon and Monday morning there is also service, all this time the weather was fine. On Monday afternoon every thing was to begin, but unfortunately on Tuesday came on a tract of bad weather, which lasted six weeks, to the infinite damage of the crop. This injudicious and unwarrantable appointment was thus most prejudicial. It must be remembered that although no operations can be carried on upon Sunday, yet if a crop be cut it is a day gained, for the most

rigid Presbyterian will admit, that that day of rest may be highly useful in drying it, and preparing it for being carried.

In Morayshire, where the climate used to be dry and early, so much reliance is placed on the weather being favourable that there is great dilatoriness. One season I left a great deal of the crop out in that province, and when I got into the Garioch district of Aberdeenshire, beyond Huntly, which the Moravians will admit is much less favoured, I found that superior diligence had almost cleared the country. In the present season Conachar, a farmer near Pitlochrie, in Atholl, took the lead of his neighbours many days, and was weeks before some of them.

In West Lothian, some years ago, the foreman on a large farm begged hard that the stooks might be stacked, but his master wanted them to be drier. The weather changed soon after, and the crop was drenched till the yellow relapsed, some into green, and some into black.

When an opportunity is once lost, and the weather, after being long fine, becomes unsettled, the danger is in proportion to the duration of the monsoon. If these observations be admitted to be at least partly well founded, I shall be satisfied if they lead to experiments on a small scale, by which there can be no loss. Thus, I anticipate that at least the expense, anxiety, injury, and reproach of the harvest being prolonged into the winter months will cease, and the character of our farmers, grain, and climate be ameliorated.

I shall only add a few words as to hay-making, in which we are wofully behind. On the south confines of Perthshire, seeing a field that had been cut some time, and was quite ruined with wet, I asked how it had happened, and was told by a neighbour that he, whose ground was 200 feet higher, had had his in stack several weeks. The fear of damp causing it to heat, leads to an exposure of such incredible duration, that perhaps no season of drought in Scotland has ever yet been long enough for it to escape the destructive alternations of wetting and drying till the hay is worn out. The system of waiting in a dry season till it gets a little rain to produce a final growth, generally ends by landing it in a long series of bad weather; and the plan of changing the small heaps into large ricks in the field, by which it is held to be safe, has the effect of unnecessarily in-

creasing the labour, adding to the delay, and withering a new and larger surface. Straw well got in would be as nourishing as hay that has had six weeks of seasoning. If the seed be the object, they must be content with "*windlestraes*" instead of hay; but if the hay be what is wanted, the late system is ruinous. It exhausts the soil, loses the longest days and warmest weather, renders the crop less weighty and nourishing, makes it liable to be discoloured and rotted by wet, occasions more trouble and expense in winning it, makes the second crop much later and lighter, and sacrifices the advantage of the rain that destroyed its predecessor.

I trust I have now made out that work may be saved with profit instead of loss.

ON THE ADVANTAGES OF PERMANENT PASTURE OVER ARABLE HUSBANDRY ON THE INFERIOR SOILS OF SCOTLAND.

The superiority of Scottish agriculture, in comparison with that of our southern neighbour, is acknowledged by every body. Such superiority could scarcely be expected to exist, independent of the disadvantages of soil and climate, without some counteracting advantages, and these are neither few nor slight. Not the least prominent, and the only one I shall notice, is the small comparative expense all kind of farm work is done for in Scotland. If the Scottish farmer had to keep the same number of servants, and in the same expensive style as the English farmer, joined with other expensive habits and customs which it is not easy to get rid of, thousands of acres of poor land in Scotland, at present uncultivated, could not bear the expense of cultivation, and would have to be turned to pasture. But, notwithstanding the prudent habits and economical mode of cultivating land in Scotland, which has extended cultivation on inferior land to such an extent, and which in England could never be thought of, it is still, I think, very doubtful that cultivation on these soils is the most profitable way of farming the land; and it is well worthy of inquiry whether, under proper management, a permanent sward of grass could not be formed on such land more profitably to the occupier than farming could ever be

expected to be on such soils, and, in consequence, more beneficial both to the proprietor and the country.

The kind of land I allude to is what is termed by farmers weak clays or soft lands, always on a strong clay retentive bottom, and as wet as land can well be from rain or surface water. I believe this in general is the character of the land in the west of Scotland, and, to a person a judge of land, is easily distinguished from rich clays.

But as land varies so much in its quality, the best way of conveying an idea on the subject is to mention the rent such land would bring in the market. What I maintain, therefore, is, that farms which bring a rent of from 15s. to 30s. per Scots acre, is, under proper management, capable of being converted to good permanent grass.

I am aware it is a common opinion, that this kind of land, if thrown out of cultivation, would become a barren moor; that grass, after it is two or three years old, is utterly worthless, and, unless again brought under the plough and again sown down with fresh grass seeds, such land would become totally valueless both to the proprietor and the community. This opinion is very current. It is brought forward by newspaper editors; even Members of Parliament in the House of Commons have insisted upon it.

It is no doubt true that grass, after the first year on this kind of land, is of the worst description, and being generally in a very wet state, and often overstocked with cattle, is so poached and destroyed that it cannot be expected to improve. The only grass seeds sown are clover and ryegrass. The clover is all gone after the first year; the ryegrass, although of the best quality on such land and in such a state, is seldom permanent. The pasture in the third season is indeed miserable, and there is no wonder at the common opinion, that permanent grass of any value is incapable of being formed on poor land.

To prevent any misconception, I may, however, state, that abundance of pasture in a field will generally bear an exact proportion to the quality of the soil, however carefully the field may have been laid down to grass. No circumstance so strongly points out the value of land as the productiveness of its pasture. I maintain, however, if the field has been put down to grass in

a careful manner, and arrived at some age, so that the roots of the indigenous grasses may have had time to have firmly rooted and established themselves in the ground, grass of a superior kind may be expected on land of inferior quality. And even although the pasture was of the most ordinary kind, as it is attended with comparatively no expense in the present state of markets, it will be found more profitable than arable husbandry.

I believe there are many districts in Scotland where arable and convertible husbandry is carried on. The land is of so poor a quality, the rent is not more than 10s. per Scots acre, that some individuals may doubt whether such lands will yield proportionally good permanent pasture. But on the contrary, the most of it will be a clay soil, so tough, hard, and steril, as to resist every attempt to form a good permanent sward upon it.

In one of the late Numbers of this Journal, there is a valuable paper on the Improvement of Natural Pasture upon poor land. I have not the Journal by me; but I think I remember it sufficiently to quote a remark or two. The writer states, that on very old grass, perhaps from time immemorial, the turf has a strength and multiplicity of roots altogether different from young pasture, and that such old turf supplies a far more abundant herbage. But on poor tough clay the grass may get mossed and otherwise degenerate, and is capable of being greatly improved by being ploughed up; but when such land is ploughed up and cropped several years in succession, the roots of the indigenous grasses are completely destroyed, and the land may remain in grass nearly half a century before it is again covered with pasture of the same quality. The writer recommends ploughing the land in the end of autumn, and in spring give the land a turn or two to break down the winter furrow or sward, and by the end of summer to sow fresh grass seeds. In this way the roots of the indigenous grasses are not rotted away as if the land had been kept in crop two or three years. The natural grasses from the old roots speedily grow up again with renewed vigour, and the pasture left in a greatly improved state. This is a new mode of improving natural pasture, which on poor land may be beneficial. But I confess I have had but little opportunity of being acquainted with arable land let under a

rent of 20s. per Scots acre; and land of this kind, if well drained, will be found to carry wonderfully good pasture without any necessity for ploughing it up in this way.

In those districts of the country where the land is chiefly a soft clay soil, I would just ask any person to examine the grass in fields which have been for a considerable time in pasture.

The rage for arable farming, stimulated by the high price corn has always brought in the market, until within these last few years, has made grass of any age very rare. But still there may be one or two such parks. At any rate, the fields around gentlemen's houses are generally in grass. Let him examine these parks, and inquire the rents they let at. I am mistaken if he does not find the rent of these parks are just double the rent of the farms around them. It may be said, the land is better; but I think it will be found there is little difference in this respect. It may also be said, the cause is the high price of grass at the particular time referred to; but if you inquire the average rent of grass in districts where the land is of the best quality, and compare it with the average rent of the farms in the neighbourhood, you will find them very much alike;—and this, likewise, is not the cause. The real cause, I suspect, is just that pasture on inferior land is produced in a proportionally greater abundance than any other crop, and is, in consequence, more profitable. And it turns out that land which was put down to pasture, chiefly with a view to ornament, as it surrounded the house of the proprietor, becomes the most valuable field upon his estate. Let the landed proprietor mark this, and inquire what effect it would have upon his rent-roll, if more of his estate were covered with pasture of as good quality; and by minutely examining the quality of the soil, and comparing it with the soil of his other farms, calculate to what extent upon his estate grass of equal value may be expected.

Let also any person look to the grass at the sides of the hedges, and other corners of the field where the plough cannot reach, and there observe the closeness and verdure of grass in its natural state over the modern grass field of two or three years of age, on land of the same kind.

I shall now notice what may be considered the best mode of

laying down land to permanent pasture, and which, if properly attended to, grass of the most productive kind may be expected.

But I shall first notice an agricultural improvement which has been introduced within these last few years, and, from trial, has been found capable of ameliorating the soft wet-bottomed soils to a very great extent. I have heard it said, the individual who first cultivated turnip as a farm crop, ought to be considered as a great public benefactor. I am rather inclined to think, he who first introduced furrow-draining, or at least he who has been most active in bringing its merits before the public, has strong rival claims with his turnip friend. There is no necessity here to go into any lengthened account of this kind of draining. Its great distinction is to draw off the rain-water from close-bottomed land. On land with a retentive subsoil, it cannot get away. In winter there is no drought to dry the ground. It is therefore continually in such a wet state, that it is what farmers term soured, and the good effects of previous cultivation is in a great measure destroyed. But experience has proved, that a small narrow drain, generally one in every ridge, filled with small stones, and then carefully filled up with the best top-soil, completely pervious to water, has the effect of keeping the land dry to a wonderful extent. Let the farmer, then, who wishes to have the best grass his land is capable of producing, take advantage of this method of draining his land. It is, in a great degree, from the wetness of the land that good natural pasture is so difficult to form. Although on old grass it is often surprising to see such abundance of pasture on land so wet that you would think it to be half covered with rushes; but in most cases, the grass becomes mossed, and what farmers term soured; and there can be no doubt, if this land was well drained, the grass would be worth three times its present value, and even this bad grass lets at as high a rent as it would do as a farm.

Indeed it it only since the introduction of this improved system of draining, that land of this kind could be laid down to grass with a view to be permanent, with any probability of success. The expense, I think, is about L.6 per acre; but this cannot, with any fairness, be charged against laying down land to pasture, as it is extensively pursued, and found to pay on cult

vated land; and there can be no doubt it will pay as well on grass land.

It would be a great improvement to sow the grass seeds without any crop. All the nourishment which goes to mature a heavy crop of grain will then go to the benefit of the seedling grasses, which must have a very great effect on their strength and thickness. An immense greater number of grass plants will be got to take root, than when they are half choked by a heavy crop of corn. This is a great advantage, and in sowing seeds without a crop, more than double the quantity should be used. There will be one objection to this mode of sowing seeds. The loss of a crop may be thought too great a sacrifice. Nothing valuable can be got without some corresponding sacrifice; but if the land is in good order, such an expense may be avoided. After a summer fallow, a crop of corn could be taken, but no grass seeds sown with it, and in the following year grass seeds could be sown without any corn crop. The only additional expense that can be calculated upon by this plan is the loss of a year's rent; on the kind of land we are considering, not a very large item.

But not more than half a year's rent can fairly be charged against it, as by August it may be expected the pasture will be very good and fit for sheep stock. It is almost unnecessary to mention, for the first two years, cattle should be carefully excluded; the land being so soft and tender, they would poach and damage it. The land should be pastured by sheep alone, and even they, I may mention, should be excluded the first year on wet days, although to practical people this is well known. The surface of the ground, previous to sowing grass seeds, should be made very fine and carefully rolled. The seeds are sown on the land after it is rolled, and are harrowed in by light grass-seed harrows. Considerable attention is required for this part of the process; the seeds of the natural grasses are very fine, and if the land is in the least degree rough, they will be, to a great extent, buried. Sowing grass seeds without a crop is not common in this country; but in England it has often been done with the most complete success.

We will now consider the kind of grass seeds to be sown; ryegrass and clover are the grasses commonly sown. When the

field is only intended to be a year or two in pasture, these seeds are perhaps all that may be necessary; but when the field is to remain for a number of years in pasture, a worse collection of seeds could not be selected. Red clover exists only the first year; white clover is an excellent plant, and so permanent it will remain for any length of time, and will grow on very inferior land, but on such land I do not think it very profitable. There are other grasses that will yield a more abundant pasture, and in consequence to be preferred. Ryegrass is by no means calculated to form a thick turf, and being the principal grass sown, no wonder at the complaints of the inferiority of pasture after the second year.

The grasses that are most to be recommended are those that are indigenous to the soil; these grasses are now sold by all the principal seedsmen. Very great attention has been paid to this subject within these last few years, and, like all new improvements, too high expectations were formed, and disappointment in many cases would follow. It is only on soils of an inferior quality, and when intended to remain a long while in grass, that it is worth while sowing natural grasses; on land which is intended to remain only a year or two in grass, it is of no use; and on land of the best kind, although intended to remain in pasture, it is, I think, of very little consequence what grasses are sown. Ryegrass on good land tillers and thickens freely. White clover on such land becomes splendid pasture for any length of time. I do not see how it is possible to desire better grass than is every day seen by sowing ryegrass and clover. It is only on land of an inferior kind, when intended to remain in grass, that the cultivation of the natural grasses is really an improvement. When the natural grasses are sown, it is a common error to expect the grass will be as good as if it were an old pasture field; but the pasture must be of some age before the roots become firmly rooted in the ground, and it will take more time on poor land than on that of good quality. Among such a variety of grasses which grow naturally on different soils, it becomes an object of some importance to select the kinds suited to the soil intended to be sown, and to sow such a quantity of the seeds of the different grasses as it is thought will make the thickest turf. I believe Mr Lawson of Edinburgh, seedsman to the Highland

and Agricultural Society, has prepared a table shewing what quantity of seeds of the different grasses it is necessary to sow to produce the same number of plants. This table must be of great use, as the seeds of some of the natural grasses are so small that one pound of one seed will produce as many plants as four pounds of another kind. Mr Lawson has also published the grasses indigenous to different soils, and the quantity of seed of each grass proper to sow; and the total quantity of seeds recommended is very properly a very liberal allowance.

Without disregarding the grasses recommended by seedsmen, let the farmer himself examine the grasses indigenous to the soil, that are found growing naturally by the sides of the hedges, and other patches out of the reach of the plough. In forming an opinion upon this subject, I do not know a safer ground to go upon than what nature has pointed out, and while he disregards those grasses that may be considered as weeds, let him carefully notice all the others as well as those that seem the most valuable, and occupy most room, and the table of Mr Lawson will be found useful in forming an opinion of the quantity of the different seeds to sow, to have a natural turf of the same kind. It is very likely the grasses he finds most common, and, in consequence, most recommendable, are first a valuable grass, Scots name dogs'-tail, several varieties of the Fescue, cow-grass, a natural vetch, a kind of red clover common on poor land in Scotland, and a number of others. Dogs'-tail is more universal, common to different soils, than any other grass. It seems to be the principal grass in many fields, let at a rent of little more than 10s., up to L.4 Sterling, per Scots acre, on land of medium quality. It is impossible to see finer grass than is usually seen where this grass predominates, and yet it has never held a prominent place in the lists of grasses recommended by seedsmen. The most valuable grass in Britain is said to be the rough cock's foot. It seems to grow chiefly on land of a better quality than what we have under consideration. Let the farmer, then, sow chiefly those grasses which he finds growing naturally, and at the same time luxuriantly, on the same kind of land which he intends to convert to pasture, joined with one or two other varieties of the best natural grasses, with a little of the best ryegrass; and if the land is

well drained, in good order, and the seeds sown without any corn crop, there will be little doubt of his success in having good pasture.

Overstocking is a very common error, by which mischief is done to a shameful extent. Young grass can never improve and become thick and close in the sward, when it is continually cropped by the cattle to the roots. It is in a great measure owing to this so much grass is spoiled by moss. Let the field always be kept rough, and this should be the case in winter too, and allow the grass to tiller out and mix together; it is also more profitable, the stock improving so much better. In order to thicken the grass as much as possible, besides under stocking, in October, when the grass is two or three years of age, it ought to get a good top dressing. At this time of the year the land is often pretty dry, the carts will not break the land, and the winter rains will wash the compost among the roots of the grass. This, I think, is all that art can do; it can now be left to improve by age, and the improvement which is effected by age is, I think, more marked on land of an inferior kind than good land. In fact, he who employs himself in converting a poor soil to permanent pasture, ought to consider himself doing something patriotic, by which posterity will be benefited.

In some districts in England during the war, corn selling at a very high price (in an evil hour), a great deal of grass land was induced to be ploughed up, of an inferior quality. It had been in grass from time immemorial, when prices fell, cultivation was not found to pay, and it was again turned to pasture. It is said the inferiority of the new over the old grass is extreme, and the loss occasioned by ploughing it up must be very great. A kind of mania existed all over the country, for conducting agricultural operations in a style which on poor land could never pay. Those country gentlemen who are termed keen farmers, were naturally the most deeply infected, and although they succeeded in procuring bulky crops, it does not follow their farming was profitable, as their farms were generally cultivated by an outlay of capital and expense which renders profit out of the question.

Turning a great deal of land to pasture, may be objected to,

as it would deprive of employment a great many country labourers, the best behaved part of the population. But it should be borne in mind, where agriculture is well understood, arable farming is found very profitable, and will always be preferred to grazing on land of medium quality. Such land is farmed at less expense than poor land. The farm requires less dung, a far greater proportion of dung being made on the farm. The cultivation of green crops and stall feeding cattle is carried on to a great extent. The grain is always of the best quality for the season, and brings the highest price in the market. But it is very different on a farm of poor clay soil, no green crop can be cultivated, and, in consequence, little good dung made, and the farmer is put to great expense every year in purchasing dung. The climate is generally wet and cold. The corn is always of bad quality.

It is absolutely necessary such land be occasionally rested in pasture. Land of so soft and weak a texture could not bear constant cropping. Now, we have seen new grass on such land after the first year is any thing but profitable. With these disadvantages, the farming of these soft clay soils is the worst business a man connects himself with. No wonder the tenantry of such land, while they are the most industrious, and live in the plainest manner, are at the same time the poorest in the country, and that proprietors who farm their own farms, although in the most careful manner, behold with astonishment not unmixed with envy the comfort and opulence of the tenantry in rich districts of the country.

There is one objection against putting down a great deal of land to grass, which may be said to render any extensive conversion of land to grass as quite impracticable, and this is the necessity in this country, with such long and severe winters, of having a sufficient supply of fodder to winter the cattle.

The necessity that must always exist for winter meat renders it no doubt necessary that a considerable quantity of land must always be cultivated, but, I think, a much less quantity will do than at first sight appears necessary. Say a farm consists of 150 Scotch acres, let 100 remain permanently in grass, and the other 50 acres cropped in a rotation of oats, summer-fallow, wheat and barley, hay, grass, grass. This will give about 9 acres to each division, and including the hay, there will be 28

acres yielding winter fodder. In the fallow division, three or four acres potatoes or turnips may be cultivated. I would prefer potatoes planted with the spade instead of smashing this kind of land with horses, when it is most likely in a wet state at the potato planting season. If the straw and hay is cut into chaff mixed with a few of the potatoes or turnips, seasoned with a little salt, it is surprising how many cattle may be kept in good condition with this quantity of fodder, quite as many as the tenant will require to winter on a farm of 150 acres, particularly if the farm be not overstocked, and the cattle have plenty of rough pasture at the end of autumn.

The practice of keeping more cattle in winter than you have sufficient straw and turnip for, is no doubt wretched management. The great object of the arable farmer is to make as much dung as he can of the best quality, and every farmer knows this is not done by keeping a great number of cattle in poor condition. But on a farm such as we are considering (although dung collecting must be attended to), the great object of the farmer is to winter in good condition all the milch cows and other stock, it will be necessary to keep when there is such a large proportion of the farm in grass. It is the muirland and hill or grazing farmer who are best acquainted with bringing a great number of cattle through the winter in good condition on a small allowance of fodder.

The pasture of such a farm could not be stocked to greater advantage than with milch cows. This important branch of husbandry will be found very profitable, and is, in general, well understood by the farmer in those parts of the country where this plan of farming is recommended. It is a useful way of employing the females of his family, and the offals, in the shape of the profits of the piggery, will go a great length in his household economy. The produce of twenty or thirty cows will bring a good sum.

A few sheep too may be kept with great advantage. There will be no turnips to winter the lambs or hoggs, but they could be sold. There is always a standing demand for bred hoggs to put on turnips. Leicester sheep, if the ewes are well wintered and not lamb too early, would thrive amazingly on this kind

of land; but it would be a great error to keep too many sheep eating the grass bare in winter, which should always be avoided. It might answer well enough to winter the ewes in a fold, and to feed them on hay and turnips, and to turn them out to the grass a part of every day for exercise. No sheep thrive so well as the solitary ewe of the cottager, kept as a companion to his cow, and it is kept the half of its time in a close byre.

But the conversion of two-thirds of a farm to pasture, is attended with another advantage I have not yet noticed. The entry to the farm with so large a proportion in grass will be Whitsunday, and it will be found a farm of 150 acres under this management, will just require one-half the capital necessary to enter the same farm at Martinmas in the state a farm of this kind is generally in when let to a new tenant.

An arable farm at entry is generally in disorder, and a great number of men and horses are required the first year, which is attended with great expense; a large sum is also required to purchase manure.

But on the other farm, from the small proportion in tillage, the expense will be very trifling. A few young stirks are soon reared to supply any deficiency. L. 200 is amply sufficient to supply the grazing department, nothing can be more clear than that L.100 will stock the one farm as well as L.800 would do the other, or that L.500 will stock the one as well as L.1000 would stock the other. It is certainly a great consideration in this plan of farming these soft clays, that independently of being more profitable, it will only require half the capital.

It may be said, if a great deal of land was turned to grass, all the productions of grass husbandry,—dairy produce, beef, and mutton,—would fall in price occasioned by the large supply; but, however extensively this plan of farming may be pursued, in certain districts of the country, the quantity of land turned to pasture, compared with the country generally, must be very trifling, and so far from it occasioning any over supply, it will be found, not one single pound less, either of butter or cheese, would be exported to this country by our Dutch neighbours.

The question that inferior arable land worth about twenty

shillings per acre, is capable of being converted to good permanent pasture, is a very important one, and to those who take an interest in agricultural subjects is extremely interesting. If individuals who are good judges of land were to examine the soil of old grass fields bearing good pasture in districts of the country where the land is generally of inferior quality, and communicate their observations to other individuals who may be similarly employed, or who take an interest in the subject, much useful information might be collected.

Of late years, corn has been selling at very low prices, while the other productions of the farm have been selling at good prices, which makes the importance of the subject still more urgent and well deserving of attention. J. B.

MISCELLANEOUS NOTICES.

I. *Physiognomy.*—The celebrated Robert Hall was very remarkable for his great insight into character; his eye appeared so searching to strangers, as to be almost insupportable—its brightness was insufferable. I have frequently heard it remarked both by ladies and gentlemen, that, until they became acquainted with him, they felt uncomfortable in his presence; he appeared to them as a discerner of the spirits. He considered himself a physiognomist. The following is an instance of his remarkable penetration:—A London corn-dealer dined one day with Mr Nutler, of Cambridge, in company with Mr Hall. Mr Nutler observed that Mr Hall was very silent at table, and that he looked very suspiciously at this stranger. After taking two or three glasses of wine, the stranger hastily withdrew. On his leaving the room, Mr Hall said, "Who is that person, Sir?" Mr Nutler informed him that he was an eminent corn-dealer from London. "Do you do any business with him, Sir?"—"Yes, Sir."—"Have you sold him any thing to-day, Sir?" "Yes, a large quantity of corn."—"I'm sorry for it, that man is a rogue, Sir."—"Oh! you are quite mistaken, Mr Hall; he is highly respectable, and can obtain credit for any amount in this market."—"I don't care for that," continued Mr Hall; "do you get your account settled as soon as you can, and never do any more business with him." Although Mr N. saw no other reason for it, Mr Hall's opinion made that impression upon him, that when his account was settled, he refused to trust the individual any more; and, in about twelve months afterwards, this very person actually defrauded his creditors, and fled the country.

II. *Frost upon Fruit Trees.*—If a thick rope be intermixed among the branches of a fruit-tree in blossom, the end of which is directed downward so as to terminate in a pail of water, should a slight frost take place during the night, it will not in the smallest degree affect the tree, while the surface of

the water in the pail which receives the rope will be covered with thin ice, though the water placed in another pail by the side of it, by way of experiment, may not, from the slightness of the frost, have any ice on it at all.

III. *Standing Orders of the House of Lords for Railway Bills, as amended,* 1837.

1. That all Standing Orders relative to Railway Bills heretofore in existence be repealed; and that in lieu thereof the following Orders be the Standing Orders relative to Railway Bills.

2. That at the commencement of every session of Parliament a Standing Order Committee shall be appointed, consisting of forty lords, besides the Chairman of the Committees of the House of Lords, who shall be always Chairman of such Standing Order Committee.

3. That three of the Lords so appointed, including the Chairman, shall be a quorum.

4. That previous to the Second reading of any private Bill, relating to Railways, in the House, such bill shall be referred to the Standing Order Committee, before which the compliance with the Standing Orders relative to notices, to the depositing of plans and sections, and books of reference, lists and estimates, and to applications for the consent of the owners and occupiers of lands, and to any other matters which may be required by the Standing Orders to be done by the parties promoting such Bill previous to the second reading of such Bill, shall be proved.

5. That any parties shall be at liberty to appear and to be heard by themselves, their agents and witnesses, upon any petition which may be referred to the Committee, complaining of a non-compliance with the Standing Orders, provided the matter complained of be specifically stated in such petition; and that such petition be presented on or before the second day after the introduction of the Bill into this House.

6. That such Committee shall report whether the Standing Orders have been complied with; and if it shall appear to the Committee that they have not been complied with, they shall state the facts upon which their decision is founded, and any special circumstances connected with the case, and also their opinion as to the propriety of dispensing with any of the Standing Orders in such case.

7. That three clear days' notice be given of the meeting of such Committee.

8. That no Committee on any private Bill relating to railways shall have power to examine into the compliance with the Standing Orders, nor into any part of the contents of any notice, list, application in writing, estimate, book of reference, or contract, nor of any plan or section, or copy of any plan or section, which are or may be hereafter ordered by any Standing Order of the House to be given, made, deposited, or produced by the parties applying for such private Bill previously to the second reading thereof in the House, excepting only in so far as may be required to enable such Committee to report as to the sufficiency of the estimate to be proved, in evidence before them, according to the Standing Orders of the House.

9. That all private Bills relating to railways, which shall have been opposed, and in which any amendments shall have been made in the Commit-

tee, shall be reprinted as amended previously to the third reading, unless the Chairman of the Committee shall certify that the reprinting of such Bill is unnecessary.

Standing Orders, Compliance with, to be proved before the Committee on Standing Orders.—1. *Notices.*—That when any application is intended to be made to Parliament for leave to bring in a Bill for making any railway, or for varying, extending, or enlarging any railway already authorized to be made, or for continuing or amending any Act passed for any of those purposes, or for the alteration of the existing tolls, rates, or duties, upon any such railway, notices of such intended application be given, except in those cases where notices in conformity with the existing Standing Orders for the session next after the present session of Parliament shall have been given in the months of February and March in the present year.

2. That such notices, except as hereinafter mentioned, do contain the names of the parishes and townships, and extra-parochial places from, in, through, and into, which any such railway is intended to be made, varied, extended, or enlarged; and shall state the time and place of the deposit of the plans, sections, and books of reference; and if an alteration in any existing tolls, rates, or duties is intended to be proposed, the intention of proposing such alteration be expressed therein. But in case any such bill shall be for the purpose only of altering any existing tolls, rates, or duties, or of continuing or amending any former act, solely for the purpose of tolls, it shall not be necessary to insert in such notices the names of the several parishes and townships and extra-parochial places.

3. That such notices be inserted in the London, Edinburgh, and Dublin Gazette, as the case may be, twice in each of the months of October and November immediately preceding the introduction into Parliament of the Bill for which such application is intended to be made, and also twice in each of the aforesaid months, in some one and the same newspaper of every county in or through which any such railway is intended to be made, or in which any railway already authorized to be made is intended to be varied, extended, or enlarged, or if there is no such paper printed therein respectively, then in the newspaper of some county adjoining thereto.

4. That the notices mentioned in the preceding Order shall also be given at the general quarter session of the peace which shall have been holden for every and each county, riding, or division, in or through which any such railway, or variation, extension, or enlargement of any railway, authorized to be made, shall be situated, at Michaelmas or Epiphany preceding the session of Parliament in which such application is intended to be made, by affixing such notice on the door of the session-house ofeach and every such county, riding, or division where such general quarter session shall be holden, save and except as to any Bill for such purposes in Scotland; in which case, instead of affixing such notices on the door of the session-house, such notices shall be written or printed on paper, and affixed to the church door of the parish or parishes in or through which such railway, variation, extension, or enlargement is intended to be made, for two Sundays in each of the months of September, October, and November immediately preceding the introduction into Parliament of the Bill for which such application is intended to be made.

5. *Plan.*—That (except in those cases where maps or plans and sections, books of reference, and copies or extracts from the same, in conformity with the heretofore existing Standing Orders for the session next after the present session shall have been deposited and lodged as required by such Standing Orders) a map or plan and section, and also a duplicate of such map or plan and section, of the whole of such intended railway, and also of any intended variation, extension, or enlargement of any railway authorised to be made, upon a scale of not less than four inches to a mile, shall be deposited for public inspection at the office of the clerk of the peace of every county, riding or division in England or Ireland, and in the office of the principal sheriff clerk in Scotland, in or through which such railway, or such variation, extension, or enlargement, is intended to be made, on or before the 30th day of November immediately preceding the introduction into Parliament of the Bill for which such application is intended to be made, which map or plan shall describe the line of such intended railway, or of such intended variation, extension, or enlargement; and the lands in or through which the same is intended to be made, together with duplicate books of reference, containing a list of the names of the owners or reputed owners, lessees or reputed lessees, and occupiers of such lands respectively; and where such railway, or such variation, extension, or enlargement, is intended to pass through any buildings, yards, court-yards, or land within the curtilage of any building, or through any ground cultivated as gardens, an additional plan of such buildings, yards, land, and ground, and of the said railway, shall be laid down upon a scale of not less than a quarter of an inch to every 100 feet; and that where it is the intention of the parties to apply for powers to make any lateral deviation from the line of any such railway or intended variation, extension, or enlargement of any railway authorized to be made, all lands included within the limits of such deviation shall be marked upon the plan; and that in all such cases an additional plan of any building, yard, court-yard, or land within the curtilage of any building, or of any ground cultivated as a garden, included within the limits of the said deviation, shall be laid down upon a scale of not less than a quarter of an inch to every 100 feet.

6. *Section.*—That the section shall be drawn to the same horizontal scale as the plan, and to a vertical scale of not less than one inch to every 100 feet, and shall shew the surface of the ground in the line of railway marked on the plan, and shall also have marked on it a line shewing the railway line when finished (which line shall correspond with the upper surface of the rails), and a datum horizontal line, which datum line shall be the same throughout the whole length of the railway, and shall be referred to some fixed point stated in writing on the section near either of the termini.

That a vertical measure from such datum line to the line of the railway shall be marked in feet and inches at each change of the gradient or inclination, and that the proportion or rate of inclination between each such change shall also be marked.

Height of Railway.—That the height of the railway over or under the surface of every turnpike-road, public carriage-road, navigable river, canal, or railway, or junction with a railway, shall be marked in figures at every cross-

ing thereof; and if there shall be no such crossing in any half-mile, then the height over or under the surface of the ground shall be marked once in that space; and if any alteration in the present level or rate of inclination of any turnpike-road, carriage-road, or railway, be intended, then the same shall be stated on the said section.

Tunnelling.—That where tunnelling as a substitute for open cutting, or arching as a substitute for solid embankment, is intended, the same shall be marked both on the plan and the section.

7. *Clerks of Peace, and Fee.*—That the clerks of the peace, or their respective deputies, do make a memorial in writing upon the maps or plans, sections and books of reference so deposited with them, denoting the time at which the same were lodged in their respective offices, and do at all seasonable hours of the day permit any person to view and examine the same, and to make copies or extracts therefrom, such person paying for the same the sum of one shilling for every such inspection, and the further sum of one shilling for every hour during which inspection shall continue after the first hour.

That one of the two plans and sections and books of reference so deposited with the clerk of the peace, shall be sealed up and transmitted by him by post to the office of the clerk of the Parliaments, on or before the 31st of December next after such deposits with the clerk of the peace.

8. *Depositing Plans, &c.*—That (except in those cases which are mentioned in the fifth of these Standing Orders) on or before the 31st of December immediately preceding the introduction into Parliament of the Bill for which application is intended to be made, a copy of so much of the said map or plan and section, so to be deposited as aforesaid, as relates to each parish through which any railway is intended to be made, varied, extended or enlarged, together with a book of reference thereto, shall be deposited with the parish clerk of each such parish in England, the schoolmaster of each such parish in Scotland, and the postmaster of the post town in or nearest to such parish in Ireland, for the inspection of all persons concerned, and at all seasonable hours of the day, such person paying for each inspection the sum of one shilling.

9. That copies of so much of the Standing Orders of this house on private Bills as relates to the deposit of plans, sections, books of reference, and other books and writings, or extracts or copies of or from the same, with the clerks of the peace of counties in England or Ireland, sheriff clerks in Scotland, parish clerks in England, schoolmasters in Scotland, postmasters in Ireland, and other persons, be made out and printed; and that one copy be delivered to every such clerk of the peace, sheriff clerk, parish clerk, schoolmaster, postmaster, and other person, at the same time, with the plan or other writing, or extract or copy of or from such plan or other writing, deposited with him.

10. That, previous to any bill for making any railway, or for varying, extending, or enlarging any railway already authorized to be made, or for continuing or amending any Act passed for any of those purposes, being brought to this house from the Commons, in which any alteration has been made in its progress through Parliament, a map or plan and section of such railway, shewing any variation, extension, or enlargement which is intended to be

made in consequence of such alteration, shall be deposited in the office of the clerk of the Parliaments; and that such map or plan and section shall be on the same scale, and contain the same particulars, as the original map or plan and section of the said railway, or any variation, extension, or enlargement of any railway already authorized to be made.

11. *Application to Owners, &c.*—That before any application is made to Parliament for a bill for making any railway, or for varying, extending, or enlarging any railway already made, previous application in writing, according to a form hereafter specified marked (A), be made to the owners or reputed owners, lessees or reputed lessees, by being sent to their usual place of abode in the United Kingdom, or, in their absence from the United Kingdom, to their Agents respectively, and to the occupiers of the lands through which any such railway is intended to be made, varied, extended, or enlarged, or within the limits of the deviation intended to be applied for; which application in writing shall point out the particular land or building belonging to such owners or reputed owners, lessees or reputed lessees, which are purposed to be taken for the purpose of such railway, and shall also state whether such railway is intended to pass through such land or building upon the level or upon an embankment or cutting, together with the greatest height of such embankment, or the greatest depth of such cutting respectively, with a reference to the number on the plan deposited with the clerk of the parish wherein such land or building is situated; and that such applications shall be made on or before the 31st day of December immediately preceding the introduction into Parliament of the bill for which such application is intended to be made; and that separate lists be made of the names of such owners, lessees, and occupiers, distinguishing which of them upon such application, have assented to or dissented from such intended railway, or such variation, extension, or enlargement, or are neuter in respect thereof: provided always, that no power shall be granted in any private bill relating to railways to deviate from the line laid out, without its being specified in the advertisement that such a power will be applied for, and to what extent.

12. *Depositing Lists, &c.*—That previous to any bill for making any railway, or for varying, extending, or enlarging any such railway already made, being brought to this House from the Commons, the lists mentioned in the preceding resolution, and estimates of the expense, and of the probable time within which the whole of such work may be completed, if not prevented by inevitable accident, written in words and not figures, and signed by the person making the same, together with a statement of any alterations in the book of reference which may have arisen since the same was deposited, be lodged in the office of the Clerk of the Parliaments, and that the receipt thereof be acknowledged accordingly by one of the clerks of the said office.

13. *Depositing Alterations.*—That where any alteration shall have been made, or shall be desired by the parties to be made, after the introduction of the bill into Parliament, in the line of railway, or any variation, extension, or enlargement of any line of railway already authorized to be made, the plans and sections for which shall have been deposited, and the notices for which shall have been given as before mentioned, a plan and section of such alteration, the same scale, and containing the same particulars as the original on

plan and section, together with a book of reference thereto, shall be deposited with the Clerk of the Peace of every county, riding, or division in England or Ireland, and in the office of the Sheriff-Clerk of every county in Scotland, in which such alteration is proposed to be made; and a copy of such plan and section, so far as relates to each parish, together with a book of reference thereto, shall be deposited with the parish clerks of each such parish in England, the schoolmaster of each such parish in Scotland, and the postmaster of the post town in or nearest to each such parish in Ireland in which such alteration is intended to be made, one month previously to the introduction of the bill for making such work into this House; and the intention to make such alteration shall be published in manner before directed in the London, Edinburgh, or Dublin Gazette, as the case may be, and some one and the same newspaper of the county in which such alteration shall be situate, or if there be no such paper printed therein, then in the newspaper of some county adjoining thereto for three successive weeks previously to the introduction of the bill into this House; and personal application, with a notice in writing, in the form herein before-mentioned, shall be made to the owners or reputed owners, lessees or reputed lessees, or in their absence from the United Kingdom to their agents respectively, and to the occupiers, of lands through which any such alteration is intended to be made; and the consent of such owners or reputed owners, lessees or reputed lessees, and occupiers, to the making of such alteration, shall be proved to the satisfaction of the Committee on Standing Orders.

14. *Plans, &c., Printed.*—That previous to the second reading in this House of any bill for making any railway, or for varying, extending, or enlarging any railway already authorized to be made, the map or plan of the said railway, or of any variation, extension, or enlargement of any railway authorized to be made, shall be engraved or printed upon the scale of an inch at least to a mile, and annexed to the printed copies of the bill, and shall be laid upon the table of this house.

15. *Corporations.*—That no bill to empower any railway company already constituted by Act of Parliament to execute any work, other than that for which it was originally established, shall be read a second time in this House, unless the Standing Order Committee shall have specially reported—

1st, That a draft of the proposed bill was submitted to a meeting of the proprietors of such Company at a meeting held specially for that purpose:

2d, That such meeting was called by advertisement inserted for four consecutive weeks in the newspapers of the county or counties wherein such new works were proposed to be executed; or if there are no newspapers published in such county or counties, then in that of the nearest county wherein a newspaper is published:

3d, That such meeting was held on a period not earlier than seven days after the last insertion of such advertisement:

4th, That at such meeting the draft of the proposed bill was submitted to the proprietors then present, and was approved of by at least three-fifths of such proprietors.

That in case any proprietor of such Company, or any person authorized to act for him in that behalf, shall at such meeting as aforesaid have dissented,

such proprietor shall be permitted, on petitioning the House, to be heard by the Standing Order Committee, by himself or his Agents.

16. *Subscription Contracts.*—That no such bill shall be read a second time unless the Standing Order Committee shall report that a subscription to the amount of three-fourths at the least of the estimated expense shall have been entered into by persons under a contract binding themselves, their heirs, executors, and administrators, for the payment of the money so subscribed.

That all subscription contracts shall contain the Christian and surnames, description and place of abode of every subscriber, his signature to the amount of his subscription, and the name of the party witnessing such signature, and the date of the same respectively.

That no subscription contract shall be valid unless it be entered into subsequent to the close of the session of Parliament previous to that in which application is made for the bill, and unless the parties subscribing to it bind themselves, their heirs, executors, and Administrators, for the payment of the money so subscribed.

That no subscription contract shall be valid unless it be proved to the satisfaction of the Standing Order Committee that previous to the introduction of the bill into this House five per cent. upon the amount of each share subscribed for has been paid, and has been expended, or remains applicable to the purposes of the railway at the discretion of the Directors of the proposed Company.

That previous to the introduction of the Bill into this House, copies of the subscription contract be printed at the expense of the promoters of the bill, and be delivered at the office of the Clerk of the Parliaments.

17. *Notice to Owners, &c.*—That before any bill is introduced into this House to vary any railway authorized by any former Act, notice in writing of such bill be given to the owners or reputed owners, lessees or reputed lessees, and occupiers of the lands in which the part of the railway authorized by the former Act intended to be relinquished by the bill is situate.

18. *Railway not to be proceeded with till certain Plans, &c., deposited.*—That in all such bills there be inserted the following clauses:

1. And be it further enacted, That it shall not be lawful for the said company to proceed in the execution of the said railway herein-before authorized to be made, unless the said Company shall have, previously to the commencement of such work, deposited with the Clerk of the peace of the several counties in England or Ireland, and in the office of the principal Sheriff Clerk in every county in Scotland, in or through which the said railway hereby authorized to be made is intended to pass, a plan and section of all such alterations from the original plan and section as shall have been approved of by Parliament, on the same scale and containing the same particulars as the original plan and section of the railway; and also with the clerks of the several parishes in England, the schoolmasters of the several parishes in Scotland (or in the Royal Burghs with the town-clerk), and the postmasters of the post towns in or nearest to such parishes in Ireland, in or through which such alterations shall have been authorized to be made, copies or extracts of or from such plans and sections as shall relate to such parishes respectively; and all persons interested shall have liberty to inspect and make extracts from or

copies of the said plans and sections, or extracts or copies thereof, paying to the officer having the custody of such plan and section, or of such extract or copy, the sum of one shilling for every such inspection, and after the rate of sixpence for every one hundred words copied therefrom.

2. *Section Alterations.*—And be it further enacted, That in making the said railway it shall not be lawful for the said Company to deviate from the levels of the said railway as referred to the common datum line described on the section so approved of by Parliament, and as marked on the same, to any extent exceeding in any place five feet, or in passing through towns two feet, without the consent of the owners, lessees, and occupiers of the land in, through, or over which such deviation is intended to be made; or in case any street or public carriage-road shall be affected by such deviation, then the same shall not be made without the consent of the trustees or commissioners, or if there be no such trustees or commissioners, without the consent of two or more justices of the peace in petty sessions assembled for that purpose, and acting for the district in which such street or public carriage-road may be situate, or without the consent of the commissioners for any public sewers, or the proprietors of any canal or navigation affected by such deviation; and that no increase in the inclination or gradients of the said railway, as denoted by the said section, shall be made in any place to any extent exceeding the rate of three feet per mile; and where in any place it is intended to carry the railway on an arch or arches, as marked on the said plain or section, the same shall be made accordingly; and where a tunnel is marked on the said plan or section, as intended to be made at any place, the same shall be made accordingly; unless the owners, lessees, and occupiers of land, in or through which such tunnel is intended to be made, shall consent that the same shall not be so made: Provided nevertheless, that it shall be lawful for the said Company, with such consent as aforesaid, and not otherwise, to make a tunnel or an arch or arches as aforesaid not marked on the said plan or section, so that no such tunnel shall be of greater length than two hundred yards, and that no two tunnels be at a less distance from each other than one hundred yards measured on the line of the railway: Provided always, that notice of every petty sessions to be holden for the purpose of obtaining such consent as aforesaid shall, fourteen days previous to the holding of such petty sessions, be given in some newspaper circulating in the county, and also to be affixed upon the church-door of the parish in which such deviation or alteration is intended to be made, or if there be no church, on some other place to which notices are usually affixed; provided also, that for the purpose of consenting to any such deviation from the said sections, and to any tunnelling or arching as aforesaid, the word "owners" shall be deemed and taken to mean such persons as are herein capacitated to agree for the sale of and to convey land for the making of the said railway; and the consent of such persons, with or without the consent of any other persons interested as owners in the said lands, shall be deemed and taken to be sufficient for such purposes.

3. *Curves.*—And be it further enacted, That it shall not be lawful to diminish the radius of any curve as described on the plan deposited with the clerk of the peace or principal sheriff clerk, unless such radius exceed one mile, nor to diminish it in any such case so that it shall become less than one mile,

nor to diminish any greater radius by more than a quarter of a mile, unless where it exceeds two miles, or by more than half a mile, unless where it exceeds three miles on the said plan.

1. *Matters of Inquiry by Committees on Bills.*—That Committees on Railway Bills do inquire into the following matters; and that they report specially thereupon, except in the cases hereafter provided:—

(1.) As to the proposed capital of the Company formed for the execution of the project, and the amount of any loans which they may be empowered to raise by the Bill; the amount of shares subscribed for, and the deposits paid thereon; the names and places of residence of the Directors or Provisional Committee, with the amount of shares taken by each; the number of shareholders who may be considered as having a local interest in the line, and the amount of capital subscribed for by them; and the number of other parties, and the capital taken by them; a statement of the number of shareholders subscribing for L.2000 and upwards, with their names and residences, and the amount for which they have subscribed.

(2.) The sufficiency or insufficiency for agricultural, commercial, manufacturing, or other purposes of the present means of conveyance, and of communication between the proposed termini, stating the present amount of traffic by land or water, the average charges made for passengers and goods, and time occupied.

(3.) The number of passengers, and the weight and description of the goods expected upon the proposed railway.

(4.) The amount of income expected to arise from the conveyance of passengers and goods, and in what proportion; stating also generally the description of goods from which the largest revenue is anticipated.

(5.) Whether the proposed railroad be a complete and integral line between the termini specified, or a part of a more extended plan now in contemplation, and likely to be hereafter submitted to Parliament, and to what extent the calculations of remuneration depend on such contemplated extension of the line.

(6.) Whether any, and what, competing lines of railroad there are existing, and whether any, and what, are in progress or contemplation; and to state, so far as circumstances will permit, in what respects the proposed line is superior or inferior to the other lines, if there be any: Provided always, that no line of railway shall be deemed a competing line in contemplation unless the plans and sections for the same, such as are required by the Standing Orders respecting railway bills, shall have been deposited with the clerk of the peace and in the office of the clerk of the Parliaments on or before the first day of March then last past.

(7.) To state what planes on the railway are proposed to be worked, either by assistant engines, stationary, or locomotive, with the respective lengths and inclinations of such planes.

(8.) To advert to any peculiar engineering difficulties in the proposed line, and to report the manner in which it is intended they should be overcome.

(9.) To state the length, breadth, and height, and means of ventilation of any proposed tunnels, and whether the strata through which they are to pass are favourable or otherwise.

(10.) To state whether, in the line proposed, the gradients and curves are generally favourable or otherwise, and the steepest gradient, exclusive of the inclined planes above referred to, and the smallest radius of a curve.

(11.) To state the length of the main line of the proposed line of the railroad, and of its branches respectively.

(12.) To state generally the fitness, in an engineering point of view, of the projected line of railroad.

(13.) If it be intended that the railroad should pass on a level any turnpike-road or highway, to call the particular attention of the House to that circumstance.

(14.) To state the amount of the estimates of the cost or other expenses to be incurred up to the time of the completion of the railway, and whether they appear to be supported by evidence, and to be fully adequate for the purpose.

(15.) To state what is the estimated charge of the annual expenses of the railroad when completed, and how far the calculations on which the charge is estimated have been sufficiently proved.

(16.) Whether the calculations proved in evidence before the Committee have satisfactorily established that the revenue is likely to be sufficient to support the annual charges of the maintenance of the railroad, and still allow profit to the projectors.

(17.) The number of assents, dissents, and neuters upon the line, and the length and amount of property belonging to each class traversed by the said railroad, distinguishing owners from occupiers; and in the case of any bill to vary the original line, stating the above particulars with reference to such parties only as may be affected by the proposed deviation.

(18.) To state the name or names of the engineers examined in support of the bill, and of those, if any, examined in opposition to it.

(19.) To state the main allegation of any petition or petitions which may have been referred to the Committee in opposition to the preamble of the bill, or to any of its clauses; and whether the allegations have been considered by the Committee, and if not considered, the cause of their not having been so.

(20.) To state, in addition, any circumstances which, in the opinion of the Committee, it is desirable the House should be informed of.

(2.) *Specific Replies.*—That this House will not proceed, except in the cases hereafter provided, with the further consideration of report of any bill until it has received from the Committee specific replies in answer to each of the questions contained in the first of the Standing Orders with regard to the proceedings of Committees on railway bills.

(4.) *Petitions.*—That in those cases where no parties shall appear in support of a petition in opposition to any bills for railways before this House, or where the opposition shall have been withdrawn, it shall be in the discretion of the Committee to determine how far it may be necessary to inquire into the facts required to be proved by the first of the Standing Orders with regard to the proceedings of Committees on railway bills.

(5.) *Provisions for Mortgage.*—That no such bill shall be read a third time in this House unless provision be made :—

(1.) That no such company shall be authorized to raise, by loan or mortgage, a larger sum than one-third of their capital; and that, until fifty per cent. on the whole of the capital shall have been paid, up it shall not be in the power of the company to raise any money by loan or mortgage.

(2.) *Level of Roads.*—That where the level of any road shall be altered in making any railway, the ascent of any turnpike-road shall not be more than one foot in thirty feet, and of any other public carriage-road not more than one foot in twenty feet; and that a good and sufficient fence of four feet high, at the least, shall be made on each side of every bridge which shall be erected.

(3.) *Crossing Roads.*—That no railway whereon carriages are propelled by steam shall be made across any turnpike-road, or other highway on the level, unless the Committee on the bill report that such a restriction ought not to be enforced, with the reasons and facts upon which their opinion is founded.

(4.) *Failure of Completion.*—That in case the work intended to be carried into effect under the authority of the bill shall not have been completed, so as to answer the objects of such bill, within a time to be limited, all the powers and authorities thereby given shall thenceforth cease and determine, save only as to so much of such work as shall have been completed within such time, with such provisions and qualifications as the nature of the case shall require.

Form (A) referred to in Page 426.

____________________ *Railway.*

No.

SIR,—We beg to inform you that application is intended to be made to Parliament in the ensuing session for "An Act [*here insert the Title of the Act*], and that the property mentioned in the annexed schedule, or some part thereof, in which we understand you are interested as therein stated, will be required for the purposes of the said undertaking, according to the line thereof as at present laid out, or may be required to be taken under the usual powers of deviation to the extent of yards on either side of the said line which will be applied for in the said act, and will be passed through in the manner mentioned in such schedule.

We also beg to inform you that a plan and section of the said undertaking, with a book of reference thereto, has been or will be deposited with the several clerks of the peace of the counties of [*specify the counties in which the property is situate*], and that copies of so much of the said plan and section as relates to the parish in which your property is situate, with a book of reference thereto, has been or will be deposited for public inspection with the clerk of the said parish, on or before the 31st day of December instant, on which plans your property is designated by the numbers set forth in the annexed schedule.

As we are required to report to Parliament whether you assent to or dissent from the proposed undertaking, or whether you are neuter in respect thereto, you will oblige us by writing your answer of assent, dissent, or

neutrality in the form left herewith, and returning the same to us with your signature on or before the day of next; and if there should be any error or misdirection in the annexed schedule we shall feel obliged by your informing us thereof, at your earliest convenience, that we may correct the same without delay.

We are, Sir,
Your most obedient Servants,

To

IV. *Standing Orders of the House of Commons on Railways.*

(1.) *To be proved before the Committee on Petitions.*—1. That the line of the railway marked upon the section shall correspond with the upper surface of the rails.

2. That a vertical measure from the datum line to the line of the railway shall be marked in feet and inches at each change of the gradient or inclination, and that the proportion or rate of inclination between each such change shall also be marked.

3. That the height of the railway over or under the surface of every turnpike road, public carriage road, navigable river, canal or railway, or junction with a railway, shall be marked in figures at every crossing thereof; and if there shall be no such crossing in every half mile, then the height over or under the surface of the ground shall be marked once in that space; and if any alteration in the present level or rate of inclination of any turnpike road, carriage road or railway, be intended, then the same shall be stated on the said section.

4. That where tunnelling as a substitute for open cutting, or arching as a substitute for solid embankment, is intended, the same shall be marked both on the plan and section.

5. That parties desiring to make any alteration in the line of any railway, the plans for which shall have been deposited, and the notices for which shall have been given as before mentioned, shall be permitted so to do, provided no one deviation shall exceed one mile in length, and provided a plan and section, as before described, of such alteration, together with a book of reference thereto, shall be deposited with the clerk of the peace of every county, riding, or division in England or Ireland, and in the office of the principal Sheriff-clerk of every county in Scotland, in which such alteration is proposed to be made, and a plan and section so far as relates to each parish, together with a book of reference thereto, with the parish-clerks of each such parish in England, the schoolmaster of each such parish in Scotland (or in Royal burghs with the Town-clerk), and the postmaster of the post-town in or nearest to each such parish in Ireland, in which such alteration is intended to be made, on or before the 30th day of November, in the year immediately preceding that in which such application is intended to be made, and that the intention to make such alteration shall be published in manner before directed, in three successive weeks in the months of October and November, or either of them, and that personal application shall be made to the owners or reputed owners, lessees or reputed lessees, or in their absence from the United Kingdom to their agents respectively, and to the occupiers of lands through which any such alteration is proposed to be made.

6. That parties desiring to make an application for a bill to vary, extend, or enlarge any line of railway, for making which an act of Parliament shall have been passed, shall be permitted so to do, provided that no one deviation shall exceed one mile in length, and provided a plan and section, as before described, of such variation, extension, or enlargement, together with a book of reference thereto, shall be deposited with the clerk of the peace of every county, riding, or division in England or Ireland, and in the office of the principal Sheriff-clerk of every county in Scotland, in or through which such variation, extension, or enlargement is proposed to be made; and a plan and section, as before described, so far as relates to each parish, together with a book of reference thereto, with the parish clerks of each such parish in England, the schoolmaster of each such parish in Scotland (or in Royal burghs with the Town-clerk), and the postmaster of the post-town in or nearest to each such parish in Ireland, in which such variation, extension, or enlargement is intended to be made, on or before the 30th day of November in the year immediately preceding that in which such application is intended to be made, and that the intention to make the application for such variation, extension, or enlargement shall be advertised in manner next before directed, in October and November; and that on or before the 31st day of December immediately preceding such application to Parliament, personal application shall be made to the owners or reputed owners, lessees or reputed lessees, or in their absence from the United Kingdom to their agents respectively, and to the occupiers of the lands through which any such variation, extension, or enlargement is proposed to be made.

7. That parties desiring to renew any application to Parliament in respect of any railway, the plans for which shall have been deposited, and the notices for which shall have been given, as directed by the Standing Orders in force at the time of such deposit, shall be permitted so to do in the session next ensuing that in which such application to Parliament was made, provided that no one deviation shall exceed one mile in length, and provided a plan and section, as before described, of such railway, together with a book of reference thereto, shall be deposited with the clerk of the peace of every county, riding, or division in England or Ireland, and in the office of the principal Sheriff-clerk of every county in Scotland, in or through which such railway is proposed to be made; and a plan and section, as before described, so far as relates to each parish, together with a book of reference thereto, with the parish-clerks of each such parish in England, the schoolmaster of each such parish in Scotland (or in Royal burghs with the Town-clerk), and the postmaster of the post-town in or nearest to each such parish in Ireland, through which such railway is proposed to be made, on or before the 30th day of November in the year immediately preceding that in which such application is intended to be made, and that the intention to make such application shall be advertised in manner next before directed, in October and November; and that on or before the 31st day of December immediately preceding such renewed application to Parliament, personal application shall be made to the owners or reputed owners, lessees or reputed lessees, or in their absence from the United Kingdom to their agents respectively, and to the occupiers of the lands through which any such railway is proposed to be made.

(2.) *To be proved before the Committee on the Bill, who are directed to report specially thereupon.*—1. That no such company shall be authorised to raise, by loan or mortgage, a larger sum than one-third of their capital; and that, until fifty per cent. on the whole of the capital shall have been paid up, it shall not be in the power of the company to raise any money by loan or mortgage.

2. That no railway whereon carriages are propelled by steam shall be made across any turnpike road or other public carriageway on the level, unless the committee on the bill report that such a restriction ought not to be enforced, with the reasons and facts upon which their opinion is founded.

3. As to the proposed capital of the company formed for the execution of the project, and the amount of any loans which they may be empowered to raise by the bill; the amount of shares subscribed for, and the deposits paid thereon, the names and places of residence of the directors or provisional committee, with the amount of shares taken by each; the number of shareholders who may be considered as having a local interest in the line, and the amount of capital subscribed for by them, and the number of other parties, and the capital taken by them; a statement of the number of shareholders subscribing for L.2000 and upwards, with their names and residences, and the amount for which they have subscribed.

4. The sufficiency or insufficiency for agricultural, commercial, manufacturing, or other purposes, of the present means of conveyance, and of communication between the proposed *termini*, stating the present amount of traffic by land or water, the average charges made for passengers and goods, and time occupied.

5. The number of passengers, and the weight and description of the goods expected upon the proposed railway.

6. The amount of income expected to arise from the conveyance of passengers and goods, and in what proportion; stating also generally the description of goods from which the largest revenue is anticipated.

7. Whether the proposed railway be a complete and integral line between the *termini* specified, or a part of a more extended plan now in contemplation, and likely to be hereafter submitted to Parliament, and to what extent the calculations of remuneration depend on such contemplated extension of the line.

8. Whether any, and what, competing lines of railway there are existing, and whether any, and what, are in progress or contemplation, and to state, so far as circumstances will permit, in what respects the proposed line is superior or inferior to the other lines; but that no line of railway shall be deemed a competing line in contemplation, unless the plan, section, and book of reference for the same shall have been deposited with the clerks of the peace and in the private office respectively, as required by the Standing Orders.

9. To state what planes on the railway are proposed to be worked, either by assistant engines, stationary or locomotive, with the respective lengths and inclinations of such planes.

10. To advert to any peculiar engineering difficulties in the proposed line, and to report the manner in which it is intended they should be overcome.

11. To state the length, breadth, and height, and means of ventilation of any proposed tunnels, and whether the strata through which they are to pass are favourable or otherwise.

12. To state whether, in the lines proposed, the gradients and curves are generally favourable or otherwise, and the steepest gradient, exclusive of the inclined planes above referred to, and the smallest radius of a curve.

13. To state the length of the main line of the proposed railway, and of its branches respectively.

14. To state generally the fitness, in an engineering point of view, of the projected line of railway.

15. If it be intended that the railway should pass on a level any turnpike road or highway, to call the particular attention of the House to that circumstance.

16. To state the amount of the estimates of the cost or other expenses to be incurred up to the time of the completion of the railway, and whether they appear to be supported by evidence, and to be fully adequate for the purpose.

17. To state what is the estimated charge of the annual expenses of the railway when completed, and how far the calculations on which the charge is estimated, have been sufficiently proved.

18. Whether the calculations proved in evidence before the committee, have satisfactorily established, that the revenue is likely to be sufficient to support the annual charges of the maintenance of the railway, and still allow profit to the projectors.

19. The number of assents, dissents, and neuters upon the line, and the length and amount of property belonging to each class traversed by the said railway, distinguishing owners from occupiers; and in the case of any bill to vary the original line, stating the above particulars with reference to such parties only as may be affected by the proposed deviation.

20. To state the name or names of the engineers examined in support of the bill, and of those, if any, examined in opposition to it.

21. To state the main allegation of any petition or petitions which may have been referred to the committee in opposition to the preamble of the bill, or to any of its clauses; and whether the allegations have been considered by the committee, and if not considered, the cause of their not having been so.

22. To state, in addition any circumstances which, in the opinion of the committee, it is desirable the House should be informed of.

(3.) *That in all such Bills there be inserted the following clauses:*—1. And be it further enacted, That it shall not be lawful for the said company to proceed in the execution of the said railway hereinbefore authorized to be made, unless the said company shall have previously to the commencement of such work, deposited with the clerk of the peace of the several counties in England or Ireland, and in the office of the principal Sheriff-clerk in every county in Scotland, in or through which the said railway hereby authorized to be made is intended to pass, a plan and section of all such alterations from the original plan and section as shall have been approved of by Parliament, on the same scale and containing the same particulars as the original plan and section of

the railway; and also with the clerks of the several parishes in England, the schoolmasters of the several parishes in Scotland (or in Royal burghs with the Town-clerk), and the postmasters of the post-towns in or nearest to such parishes in Ireland, in or through which such alterations shall have been authorized to be made, copies or extracts of or from such plans and sections as shall relate to such parishes respectively; and all persons interested shall have liberty to inspect and make extracts from or copies of the said plans and sections, or extracts or copies thereof, paying to the officer having the custody of such plan and section, or of such extract or copy, the sum of 1s. for every such inspection, and after the rate of 6d. for every one hundred words copied therefrom.

2. And be it further enacted, That in making the said railway it shall not be lawful for the said company to deviate from the levels of the said railway as referred to the common datum line described on the section so approved of by Parliament, and as marked on the same, to any extent exceeding in any place five feet, or in passing through towns two feet, without the consent of the owners, lessees, and occupiers of the land in, through, or over which such deviation is intended to be made; or in case any street or public carriage-road shall be affected by such deviation, then the same shall not be made without the consent of the trustees or commissioners, or, if there be no such trustees or commissioners, without the consent of two or more Justices of the Peace in petty sessions assembled for that purpose, and acting for the district in which such street or public carriage-road may be situate, or without the consent of the commissioners for any public sewers, or the proprietors of any canal or navigation affected by such deviation; and that no increase in the inclination or gradients of the said railway, as denoted by the said section, shall be made in any place to an extent exceeding the rate of three feet per mile; and where in any place it is intended to carry the railway on an arch or arches, as marked on the said plan or section, the same shall be made accordingly; and where a tunnel is marked on the said plan or section as intended to be made at any place, the same shall be made accordingly, unless the owners, lessees, and occupiers of the land in or through which such tunnel is intended to be made shall consent that the same shall not be so made: Provided nevertheless, That it shall be lawful for the said company, with such consent as aforesaid, and not otherwise, to make a tunnel or an arch or arches as aforesaid not marked on the said plan or section, so that no such tunnel shall be of greater length than 200 yards, and that no two tunnels be at a less distance from each other than 100 yards measured on the line of the railway: Provided always, That notice of every petty sessions to be holden for the purpose of obtaining such consent as aforesaid, shall, fourteen days previous to the holding of such petty sessions, be given in some newspaper circulating in the county, and also to be affixed upon the church-door of the parish in which such deviation or alteration is intended to be made, or if there be no church, some other place to which notices are usually affixed; and provided also, That for the purpose of consenting to any such deviation from the said sections, and to any tunnelling or arching as aforesaid, the word "owners" shall be deemed and taken to mean such persons as are herein capacitated to agree for the sale of and to convey land for the making of the

said railway; and the consent of such persons, with or without the consent of any other persons interested as owners in the said lands, shall be deemed and taken to be sufficient for such purposes.

3. And be it further enacted, That it shall not be lawful to diminish the radius of any curve as described on the plan deposited with the clerk of the Peace, or principal Sheriff-clerk, unless such radius exceed one mile, nor to diminish it in any such case so that it shall become less than one mile, nor to diminish any greater radius by more than a quarter of a mile, unless where it exceeds two miles, or by more than half a mile, unless where it exceeds three miles on the said plan.

4. That this House will not proceed with the further consideration of report of any such bill, until it has received from the committee specific replies in answer to each of the questions contained in the foregoing resolutions.

5. That in order to afford time for the proper discussion of the reports on railway bills, the House will upon every Tuesday proceed at five o'clock to the consideration of reports on such bills.

V. *Horse Match to Hereford.*—One morning at six, a mare, the property of Mr Burke, residing at Hereford, started from London, for a wager of 200 guineas, to proceed against the Mazeppa light Hereford coach, which travels at the rate of 10 miles an hour, including stoppages; the distance from London is 138 miles. The mare was not to be ridden or driven, but led by riders, who were prepared with proper relays of horses on the line of road. At starting, the bets, which were considerable, were in favour of the mare; she succeeded in completing the undertaking, arriving at Hereford 20 minutes before the coach. The poor animal on her arrival was greatly distressed.

VI. *Steamer Lights.*—Lieutenant Bellairs, of the Royal Navy, has suggested the following arrangement of a system of distinguishing lights for steam-vessels, which, we think, seems at once plain, simple, and efficient:—

1. A circular light, at the foremast-head, of a natural colour, to be seen from every part of the horizon.

2. Before each paddle-box to fit a light which shall be seen a-head, on the bow or on the beam, forming, with the mast-head light, a combination of *three* lights, when the steamer is taken end-on or right a-head, and of only *two* lights, when seen in a bow view or on the beam.

3. A light on each quarter, or *after* part of the paddle-boxes, which shall be seen right astern and on each quarter; forming, with the mast-head light, a combination of *three* lights, when the steamer is taken end-on or right astern, and of only *two* lights, when taken in a quarter view.

4. Let the *starboard* lights be invariably of a *bright red*—thus, the course the steamer is running is clearly shown.

Mr Bellairs suggests that these lights should be produced by gas generated on board, but as it is evidently immaterial by what means the lights are procured, oil lights, with powerful reflectors, would answer the purpose equally well, and obviate the objection which might be raised to the gas on the score of danger.

QUARTERLY AGRICULTURAL REPORT.

November 1837.

Our last report left us at the commencement of harvest since then, the weather having exhibited some extraordinary vicissitudes, they deserve particular notice. The very fine weather for vegetation terminated about the end of July, when heavy thunder showers frequently fell, and laid the crops to an unprecedented degree; still, had the genial warmth of the preceding weeks returned, they would, no doubt, have partially recovered their natural position, and filled the grain to plumpness. As it was, the heavy rains changed the character of the weather for the worse for the remainder of the season. A considerably lower temperature, and consequent repetition of showers, characterised the weather of August and September, and as the late spring had caused an unequal braird of spring corn in unequal altitudes, the wet and cold autumnal months retarded the ripening process to a very late period. Indeed it was conceived at one time, that the oats, in late districts, would never ripen at all. For these reasons, harvest work was not entirely finished until the end of October, thus continuing from the third week of August, a period of not less than nine weeks.

Those who began harvest early had another difficulty to contend with. Whilst the cutting down continued when the corn was dry, none of it could be led into the yard for want of drying winds; and so long did this soft state of the atmosphere continue, that we knew several farmers in the low country who had entirely finished cutting down before a single sheaf was carried to the stack-yard. And, even after the carrying commenced, the difficulty was not at an end, for much of the barley proved to be too hastily taken in, and indicated heating, and stacks had to be turned. But the farmers in high districts were better of. Those who had nothing ready for cutting until the end of September, continued their harvest-work with little interruption, and carried all their crop in in good order.

Judging of the quality of the crop from its early quickness of growth, when it was laid down, and the dilatoriness of its filling in the subsequent wet and cold weather, and the bracing and hardening state of the atmosphere afterwards, we should naturally conclude that its quality must be very various. Accordingly, more contradictory accounts could not be received than of the quality of the grain this season. Almost the very best and the very worst qualities may be obtained. In regard to bulk, the straw is every where plentiful. The oats we should pronounce a full and a fine crop, and we hear that it meals largely. Barley is the next in bulk, but not true in gist. Little or none of it is sprouted, and it may therefore malt pretty freely. Wheat is the crop which will deceive the farmer most in thrashing, although we dread no scarcity of it.

The heavy rains immediately after the singling of the turnips, gave them a check which they have never recovered, and consequently, in all

the early districts, they will not be a heavy crop, and are mildewing strongly. Those which were singled after the rain, are good. The very late are very middling.

Potatoes present no blanks in the drills. This phenomenon this season, we have endeavoured to explain in a preceding article. The bulk of the crop is not equal to the expectation cherished from the state of the stem, and it has, moreover, been remarked, that the crop has yielded many small potatoes, but the quality of all is unexceptionably fine. It is impossible to see tubers more meally and firm, when cooked.

The condition of stock should be good, both in upland and lowland districts. The demand has been brisk this autumn, on account of the prospect of the plentifulness of winter keep, and, of course, prices are good. Prices of corn rate moderately, indeed, that of wheat cannot rise with potatoes so fine, and oatmeal so abundant. The fine character of the weather, for some time past, will no doubt induce many to sow a large breadth of wheat.

The raw-grain distillers, who make whisky for the English market, threaten to stop their works on account of the disadvantages which they allege they have to encounter in the competition with the English distillers, who are very favourably dealt with by the excise laws. It is very likely they are unfairly treated by these laws, and we believe they are; but their condition this year is certainly not worse than it has been for years past, when no public complaints at least were uttered. We trust, however, now that they have spoken out, they will get their condition amended to their satisfaction in this parliament.

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarter and Years ended on the 10th of Oct. 1836, and 10th of Oct. 1837,—shewing the Increase and Decrease on each head thereof.

	Quarters ended Oct. 10.		Increase.	Decrease.	Years ended July 5.		Increase.	Decrease.
	1836.	1837.			1836.	1837.		
	£	£	£	£	£	£	£	£
Customs, ..	6,353,777	5,436,116	..	917,661	20,166,917	18,372,944	..	1,773,973
Excise, ...	3,862,029	3,706,467	..	155,562	12,988,173	12,007,238	..	280,9[illegible]
Stamps, ...	1,744,741	1,622,252	..	122,489	6,796,439	6,461,282	..	335,157
Post-Office,	399,000	418,006	19,006	..	1,486,000	1,490,743	4,743	..
Taxes, ...	334,887	308,092	..	26,795	3,670,747	3,693,380	22,633	..
Miscellaneous,	6,240	2,701	..	3,539	52,533	44,635	..	7,[illegible]
	12,700,674	11,492,634	19,006	1,227,046	44,460,809	42,070,222	27,376	2,417,[illegible]
	Deduct Increase,			19,006	Deduct Increase,			27,376
	Decrease on the quarter,			1,208,040	Decrease on the year,			2,390,587

[M]ONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Quantities o[f] [C]orn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quantitie[s] [u]pon which duties have been paid for home-consumption, during the same Month; and the Quan[ti]ties remaining in Warehouse at the close thereof, from 5th August to 5th October 1837.

	IMPORTED.			CHARGED WITH DUTY.			REMAINING IN WAREHOUSE.		
	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.
37.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. B
.	46,484 6	..	46,484 6	1,463 3	1,654 4	3,117 7	628,561 0	21,415 1	649,976
.	1,613 7	..	1,613 7	..	..	..	38,947 3	..	38,947
.	102,457 0	..	102,457 0	160,814 7	..	160,814 7	228,803 1	..	228,803
.	5,629 6	..	5,629 6	..	..	..	16,443 4	..	16,443
.	13,029 4	..	13,029 4	6,924 5	..	6,924 5	53,808 4	..	53,808
.	17,095 1	..	17,095 1	5,859 3	..	5,859 3	42,456 4	..	42,456
.	186,310 0	..	186,310 0	175,062 2	1,654 4	176,716 6	1,009,020 0	21,415 1	1,030,435
.	70,810 4	39 6	70,850 2	15,995 5	6,244 5	22,240 2	675,573 5	15,018 4	690,592
.	7,001 7	..	7,001 7	..	..	..	40,544 6	..	40,544
.	94,417 6	..	94,417 6	63,258 5	..	63,258 5	255,805 4	..	255,805
.	2,090 7	..	2,090 7	40 5	..	40 5	18,257 4	..	18,257
.	14,659 6	..	14,659 6	50,652 6	..	50,652 6	17,596 7	..	17,596
.	16,058 7	..	16,058 7	6,259 1	..	6,259 1	52,220 6	..	52,220
.	205,039 5	39 6	205,079 3	136,206 6	6,244 5	141,451 3	1,065,999 0	15,018 4	1,075,017
.	105,432 6	..	105,432 6	163,462 5	4,311 2	167,773 7	601,476 0	10,719 6	612,195
.	..	..	..	..	..	..	40,508 2	..	40,508
.	78,081 3	..	78,081 3	74,470 5	..	74,470 5	255,240 4	..	255,240
.	148 3	..	148 3	5,054 4	..	5,054 4	13,351 3	..	13,351
.	7,689 3	..	7,689 3	3,688 3	..	3,688 3	21,623 0	..	21,623
.	15,750 5	..	15,750 5	39,716 6	..	39,716 6	28,087 6	..	28,087
	207,102 4	..	207,102 4	286,392 7	4,311 2	290,704 1	960,286 7	10,719 6	971,006
	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr.
.	24,354 3 3	8,136 2 20	32,491 1 23	120 1 22	2,432 2 0	2,552 3 22	155,671 0 13	23,332 3 17	179,004 0
	..	..	..	..	..	..	477 2 23	..	477 2
.	24,354 3 3	8,136 2 20	32,491 1 23	120 1 22	2,432 2 0	2,552 3 22	156,148 3 8	23,332 3 17	179,481 2
.	33,330 0 19	347 0 12	33,677 1 3	3 2 20	6,538 2 17	6,542 1 9	164,477 1 10	17,638 0 12	182,115 1
.	361 3 1	..	361 3 1	139 3 8	..	139 3 8	337 3 15	..	337 3
.	33,691 3 20	347 0 12	34,039 0 4	143 2 0	6,538 2 17	6,682 0 17	164,815 0 25	17,638 0 12	182,453 1
.	25,481 2 5	12,762 2 26	38,244 1 3	499 0 4	7,164 0 15	7,663 0 19	152,918 0 11	22,798 3 27	175,711 0
	7 1 9	..	7 1 9	..	..	..	345 0 24	..	345 0
,	25,483 3 14	12,762 2 26	38,251 2 12	499 0 4	7,164 0 15	7,663 0 19	153,253 1 7	22,798 3 27	176,056 1

PRICES of BUTCHER-MEAT.

	SMITHFIELD, Per Stone of 14 lb.		MORPETH, Per Stone of 14 lb.		EDINBURGH, Per Stone of 14 lb.		GLASGOW, Per Stone of 14 lb.	
[D]ate.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
[18]37.								
[A]ug.	6/3 @ 8/	6/3 @ 7/9	6/6 @ 7/9	6/6 @ 8/	6/6 @ 7/6	6/9 @ 7/9	7/ @ 8/	7/3 @ 8/3
[Se]pt.	6/6 8/3	6/6 8/6	6/3 8/	6/6 8/3	6/3 7/6	6/6 7/6	6/9 7/9	7/ 8/
[O]ct.	6/ 7/9	6/6 8/	6/ 7/6	6/ 7/9	6/ 7/	6/3 7/	6/3 7/3	6/6 7/6

PRICES of English and Scotch WOOL.

[E]NGLISH, per 14 lb.—*Merino*, 24/ @ 25/6; in Grease, 13/6 @ 18/6.—*South Down*, 15/ @ 21/; *Leicester*, [...], 18/ @ 20/; Ewe and Hogg, 14/ @ 18/.—*Locks*, 9/ @ 11/; *Moor*, 7/6 @ 9/6.
[S]COTCH, per 14 lb.—*Leicester*, Hogg, 15/ @ 18/; Ewe and Wether, 13/ @ 15/6.—Ewe, 10/6 @ 12/6: *Cheviot*, [...]e, 9/6 @ 12/6; Laid, Washed, 8/ @ 9/; Unwashed, 6/6 @ 7/6; *Moor*, White, 6/6 @ 7/6; Laid, Washed, [...] @ 6/3 Unwashed, 4/9 @ 5/6.

TABLES OF PRICES, &c.

The Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.	Barley.	Oats.	ye.	Pease.	Beans.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Aug. 4.	62 10	28 2	23 11	39 6	40 5	39 4
11.	63 1	27 10	23 10	37 8	39 2	37 6
18.	62 2	27 9	24 0	37 6	39 6	38 8
25.	61 1	26 7	22 11	37 1	39 2	39 2
Sept. 1.	59 6	29 0	23 2	35 6	38 4	37 5
8.	60 6	28 10	22 9	34 4	38 0	37 1
15.	62 5	28 11	23 0	33 9	37 2	38 3
22.	61 3	26 11	22 6	32 10	37 1	38 8
29.	59 6	27 3	23 7	32 8	36 10	39 4
Oct. 6.	60 0	29 5	23 9	32 4	35 11	30 11
13.	57 9	31 2	22 11	33 0	36 2	36 11
20.	55 8	31 9	23 7	31 10	36 10	35 0
27	53 11	30 7	26 5	32 3	36 4	33 1

DUBLIN.

Date.	Wheat Per Bar. 20 St.	Barley Per Bar. 16 St.	Bear Per Bar. 17 St.	Oats Per Bar. 14 St.	Flour Per Br. 9 St.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.
Aug. 4.	35 0	15 6	13 0	14 6	20 6
11.	36 0	15 2	13 4	14 9	20 6
18.	34 6	14 10	12 6	14 0	20 0
25.	34 0	14 6	12 10	14 0	20 2
Sept. 1.	32 10	14 4	13 0	14 6	20 0
8.	28 6	15 0	12 9	13 10	19 6
15.	29 2	14 6	11 8	14 9	19 10
22.	30 4	14 0	11 9	13 6	19 6
29.	29 6	13 6	10 0	12 0	19 9
Oct. 6.	28 0	13 0	11 0	11 9	18 8
13.	27 0	13 6	10 9	10 6	19 6
20.	28 2	14 6	11 3	11 6	18 6
27.	29 0	15 0	11 6	13 0	19 6

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Aug. 4.	57 3	23 0	22 10	36 6	40 7	43 10
11.	58 4	24 9	22 3	36 10	40 1	43 3
18.	57 7	27 10	21 10	37 6	40 3	43 1
25.	55 7	24 6	22 2	37 4	39 6	43 5
Sept. 1.	52 4	22 1	21 0	36 8	38 10	42 2
8.	49 7	23 11	21 3	35 6	37 9	42 3
15.	52 0	25 5	20 8	34 10	37 4	30 0
22.	47 8	25 5	20 7	34 2	36 0	40 6
29.	53 1	24 2	20 9	33 6	37 2	40 3
Oct. 6.	50 9	24 3	22 5	33 2	36 10	42 5
13.	47 10	24 0	21 3	33 0	35 5	41 9
20.	45 9	24 0	19 8	32 8	34 8	42 6
27.	46 8	26 6	19 8	32 2	36 2	42 11

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.
Aug. 2.	61 6¼	31 10	31 2	41 0	41 6
9.	60 0	32 3	30 8	40 10	41 7
16.	59 1	31 6	31 0	40 0	40 6
23.	58 0	31 2	31 6	39 6	40 0
30.	57 9	30 0	31 0	39 8	40 6
Sept. 6.	60 0	29 6	30 1	39 4	40 6
13.	62 6	34 0	29 2	39 0	39 6
20.	63 0	28 6	25 4	39 6	39 6
27.	60 0	27 4½	24 0	38 8	39 6
Oct. 4.	58 0	28 0	23 6	39 0	40 0
11.	57 0	30 0	23 8	38 6	39 6
18.	58 2	31 6	24 0	38 8	39 2
25.	57 9	30 6	23 6	38 9	39 8

TABLE showing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV. c. 58, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN; the Duties payable thereon, from Aug. to Nov. 1837.

Date.	Wheat. Weekly Average.	Wheat. Aggregate Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggregate Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggregate Average.	Oats. Duty.	Rye. Weekly Average.	Rye. Aggregate Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggregate Average.	Pease. Duty.	Beans. Weekly Average.	Beans. Aggregate Average.	Beans. Duty.
1837.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Aug. 4.	60 1	57 7	29 9	27 8	29 2	19 10	24 2	24 5	10 9	30 8	36 6	15 6	40 7	40 7	9 6	41 3	40 9	9 [illegible]
11.	59 3	58 0	28 9	28 7	24 2	19 10	24 2	24 2	10 9	37 3	36 11	15 6	38 7	40 3	9 6	40 0	40 9	9 [illegible]
18.	59 6	58 6	28 8	28 0	28 5	19 10	24 5	24 2	10 9	37 4	37 4	14 11	39 6	40 0	9 6	40 5	40 10	9 [illegible]
25.	58 2	58 11	28 8	27 6	28 0	19 10	23 8	24 1	10 0	35 2	37 1	14 0	36 0	39 0	9 6	39 9	40 [illegible]	9 [illegible]
Sept. 1.	56 6	58 10	28 8	26 1	21 0	19 10	23 6	23 11	12 3	33 7	36 9	15 6	35 6	34 6	13 0	39 9	40 6	9 [illegible]
8.	56 6	58 4	28 8	29 0	28 3	19 1	23 3	23 10	12 3	34 7	36 3	15 6	35 11	37 9	14 0	40 4	40 4	9 [illegible]
15.	57 8	57 11	29 8	28 7	28 5	19 10	23 3	23 8	12 3	33 8	33 9	16 8	36 4	37 1	14 0	40 3	40 2	9 [illegible]
22.	56 7	57 6	29 [illegible]	29 0	28 6	19 10	22 11	23 6	12 3	32 11	34 6	16 3	37 2	36 9	15 6	40 0	40 1	9 [illegible]
29.	56 0	57 [illegible]	29 8	20 5	27 0	19 10	23 0	23 3	12 3	32 4	33 8	19 9	36 5	36 5	15 6	40 0	48 1	9 [illegible]
Oct. 6.	55 9	56 7	30 8	30 2	29 0	18 4	23 8	23 1	12 3	32 5	33 2	19 9	[illegible] 11	[illegible] 4	15 6	40 3	40 2	9 [illegible]
13.	53 6	56 1	30 8	30 9	29 4	18 4	21 9	22 10	13 9	32 7	33 0	19 9	36 5	36 6	15 6	39 10	40 1	9 [illegible]
20.	51 8	55 3	31 6	30 4	29 5	18 4	22 3	22 8	13 9	30 7	32 3	21 3	34 11	36 4	16 0	20 10	39 9	11 [illegible]
27.	51 0	54 9	33 6	29 11	29 9	18 4	21 7	22 4	13 9	30 6	31 10	22 8	36 2	30 4	13 6	35 8	38 9	12 [illegible]

THE QUARTERLY JOURNAL OF AGRICULTURE.

STUDIES IN AGRICULTURE.—NO. II.

Rotation of Crops illustrated by the Failure of the Potato and the Red Clover.

The two chief divisions of cultivated plants—Annuals and Perennials—are naturally propagated, with few exceptions, in two principal ways, namely, by shedding their seeds or by producing young plants, in the various forms, according to the genera, of suckers, offsets, or runners above ground; or of new root-stocks (*Rhizomata*), bulbs, corms, or tubers, beneath the surface of the soil—all, so far as our limited knowledge can perceive, regulated by that wise law of Providential wisdom, established to prevent any particular spot from being overoccupied with organized beings, that is, with more than can find wholesome food.

If we observe the proceedings of animals, we shall find this remarkable law in universal operation. When a kitten is old enough to lap milk from a basin, or to eat a bit of meat, the mother-cat, that had previously nursed it with so much care,—fiercely defending it, at the danger of her own life, against the intrusions of strange dogs of thrice her size,—now relaxes in her maternal duties, and when it offers to suck or even to play, she hisses, growls, and spits at it, and often does not hesitate to cuff and buffet it about with her paws. Day by day, she becomes more spiteful to the former object of her tenderest care, till, at length, if it be not otherwise removed, she will with difficulty allow it to remain under the same roof with herself.

The apparently barbarous instinct in the mother-cat, is naturally prompted, in the first instance, by the supply of milk in the udder becoming scanty, and no doubt causing uneasiness or pain when the kitten attempts to suck ; but the final cause appears to be the diffusion of the species over a greater extent of surface, and more particularly the regulation of numbers to the supply of food.

Accordingly, we find that animals of prey are, with few exceptions, in small numbers in any given locality, such as the hereditary pair of magpies established for years about the trees of a Scotch farm-yard, and as regularly driving off their young to shift for themselves as the mother-cat does her kittens,—reserving for their own eating the hedge-laid duck's egg, or the captured chick, as well as the offal and garbage, of which the supply is too precarious to maintain a colony of magpies, as numerous as that of the pertinacious sparrows, their neighbours in the yard. A pair of corbies or ravens will, in the same way, maintain their hereditary territory intact from all intruders, because the sickly lambs which they can attack on a sheep-farm or two, or the braxy hoggs, must, in the most unhealthy seasons, be limited in number; and like the fabled Upas tree of Java, which will allow, it is said, no other plant to grow within its sphere, the ravens require exclusively all the food which the locality produces.

The sheep, on the other hand, on whose carcass the ravens prey, live harmoniously in large flocks, on the same principle of being able to find food, as the gregarious herbage (if I may use the expression) on which they feed, finds nourishment. Between the flocking sparrows or the gregarious sheep, and the solitary pair of magpies or ravens, there are numerous intermediate gradations, just as there are in the vegetable world, where we see bent and heath occupying miles of country almost exclusively, while the yew-tree and the ash will scarcely allow a blade of grass or any sort of weed to grow in their vicinity, lest they be robbed of the food which they absolutely require, and cannot travel in search of.

This highly interesting principle of diffusion among organized beings, is so well illustrated by the proceedings of the several species of ants, that I cannot put the subject in a more

striking point of view than by detailing what has passed under my own eye in numerous instances. It may be necessary to state, that there are three sorts of ants in every ant-hill, namely, females of a large size, males of a small size, and workers of a middling size, who forage for provisions, and construct the general habitation. At the pairing season, the males and the females acquire wings and escape from the colony, to the great consternation of the workers, as the colony depends on them for the increase of its population, and they consequently endeavour to prevent their egress.

Some of the females, after pairing, are usually captured by the working ants, and conducted back to the parent community to lay their eggs; and others are laid hold of by straggling parties of from two to a dozen workers, who do not return to the parent community, but commence small colonies on their own account. This explains the common occurrence of a great number of small colonies being formed in the immediate vicinity of each other, while sometimes the parent community is thereby quite broken up and the hill deserted. This happens frequently in the case of the red ant (*Formica rubra*) and the ash-grey ant (*Formica fusca*), both very common species in fields and gardens. In the case of the yellow ant (*F. flava*), again, and of the wood ant (*F. rufa*), this rarely occurs, the parent community often remaining on the same spot for years together.

When a female, after pairing, does not chance to fall in with any scouting parties of workers, she proceeds without their assistance to found a colony herself, in the same manner as is always done by the females of the social wasps and humble bees every spring. I have repeatedly verified this fact, both by confining a single female after pairing and witnessing her proceedings, and by discovering in the fields single females occupied in laying the foundations of a future city for their progeny.

Now it must be obvious to every observer, that this diffusion of the colonies of the red and the grey ants proceeds on the same principle, and is very similar to the diffusion of the winged seeds of the dandelion, groundsel, and thistle, or the projected seeds of the heart's-ease and touch-me-not (*Impatiens Noli-me-tangere*); while the stationary colonies of the yellow and the wood ant as much resemble the stationary trees and bushes in

their vicinity. The seeds fly to a distance from the mother plants in the same way as the female ants fly from the ant-hills where they had been hatched and reared, and the analogy holds no less in another remarkable circumstance:—within a few hours after the female ant has been impregnated, and as soon as she sets about her duties as a mother, she loses her wings (Huber says she strips them off herself), intended, it would appear, only as a temporary means of aiding her in going to a distance, in the same way as the fine feathery wings of the dandelion and thistle, after wafting the seeds through the air to a fresh spot of ground, fall off as of no farther use, and leave them to germinate.

It is very clear, without going the whole length of the well known doctrine of Malthus, that the due growth and thriving of both animals and plants must depend on a proper supply of food; for if the food be scanty in quantity, atrophy in one form or other must inevitably ensue. Other circumstances, however, require to be taken into account, besides the quantity of food, in all inquiries respecting the healthy growth of organized beings; and, in particular, it is indispensable not only that the food be wholesome, but that it may be adapted to peculiarities of individual constitution. One or two examples will serve to illustrate these interesting points.

Lord Kames planted a root of bryony in a rich garden border, without, perhaps, any view to experiment; but he soon found that the rich soil was not suitable, for the plant made all haste to get away from it, and established itself in the adjacent gravel-walk. In the same way, a plant of well-ink or brooklime (*Veronica Beccabunga*) in a syke, a drain, or a ditch, will extend its roots along the water-course, but will never send a single runner towards the contiguous dry ground of the bank, no more than the yellow stone-crop (*Sedum acre*), if growing on the dry bank, will extend a single shoot into the watery domain of the brooklime. We might as well expect to see the barn-door hen taking the water after the ducklings which she has hatched, or stealing away to lay her eggs in secret among the sedges, at the side of a pond; or to see the ducks at night mounting the steps to the hen-roost.

By a comparison of the numerous facts connected with the

diffusion of plants, I have been led to the inference, that *plants, in general, will be found to deteriorate the soil, in proportion to their natural facilities of establishing a new progeny, at a distance from the deteriorated soil; and, consequently, that such facilities, or the want of them, furnish good indications to the cultivator, of the extent or rapidity of the deterioration caused by particular species.* The nature of this deterioration, whether it arises from exhaustion or contamination of the soil, or both, is a subject of the highest interest, which will be considered as we proceed to illustrate the deterioration and the diffusion.

Diffusion of Perennial Plants.

Leaving diffusion by means of seeds out of consideration for the present, perennial plants diffuse themselves, as has already been mentioned, by means of suckers, offsets, or runners above ground, and of new root-stocks, bulbs, corms, or tubers, beneath the surface of the earth. Each of these it will be convenient to illustrate separately.

Suckers.—When a tree finds the soil deteriorated either by exhaustion or contamination, or both, so that the root-fibres can no longer supply the demand of the leaves and young shoots for sap, it endeavours to escape from the place where it grows, not by self-removal, which is impossible, but by sending up from the roots suckers, that may push their individual roots beyond the sphere of the deteriorated soil.

It will accordingly be found, that no healthy young tree, whether it be a fruit or a forest-tree, will push suckers so long as the soil it is planted in remains fresh, rich, and uncontaminated. But look at an old plum or pear tree in the orchard, or a decaying currant or gooseberry bush, or a rose-tree that has stood in the border for several years, and the suckers around them will shew how ill they relish the old deteriorated soil in which they grow, and how many efforts they make to travel out of it.

Nothing can more forcibly prove the great importance of annually digging in as much rich compost or fresh soil as possible, around the roots of all trees and bushes. Were it possible, indeed, to renew the soil entirely every two or three years,

I doubt not that suckers, which are a sure indication of a deteriorated soil, might be entirely prevented, while the trees would be kept in very superior health and growth.

Slow growing trees, such as the mulberry, the walnut, and the oak, deteriorate the soil much more slowly than quick growing trees, and hence it is that they continue in healthy growth for so many years, annually extending their roots over a comparatively very limited space, while the great masses of leaves which they shed every autumn decay, and form a rich natural top-dressing of the best description. Such trees, therefore, rarely send up suckers, inasmuch as they do not require to escape from the soil.

It arises from the same final cause, that trees and shrubs which indicate a deterioration of the soil by sending up suckers from their roots, make little effort to diffuse themselves by means of seeds. Accordingly, when fruit trees or flowering shrubs,—such as the lilac and the rose, are observed to send up many suckers, they either produce few flowers, or those flowers which they do produce, are rarely succeeded by mature seeds or fruits. While, on the other hand, slow growing trees though very old, and even when not very healthy, frequently produce abundance of seeds or fruits, but not a single sucker; of which the oak and the hawthorn are examples that few may not have remarked to be prolific bearers, almost in proportion to their age, without ever sending up a single sucker.

The vine forms an apparent exception; but it is only apparent: it is very quick growing. Some of those on very open walls will make shoots in one season of two or three yards in length; but in proportion to the rapidity and extent of the growth of these summer shoots, the roots extend proportionally into new soil, and thus escape from the spot which they had deteriorated, without the necessity of pushing up suckers,—which the vine, so far as I know, never does; probably because it has other means of diffusion in the abundance of its fruit generally (as Mr Clement Hare has demonstrated with original ingenuity) in proportion to its age, or at least to the girth of the stem just above the ground. Besides, were a vine left to its natural growth, it would become diffused by the long branches falling down upon the ground, where, if accidentally covered with soil, they

would catch root as readily as a bramble is well known to do in similar circumstances.

It is well known, that the practice of the best cultivators accords entirely with those views. For example, Mr Rivers of Sawbridgeworth, Hertfordshire, one of the most extensive growers of roses in England, says, that it is necessary to remove roses every three years from the spots they have occupied, in order to prevent their degenerating. He finds, indeed, from experience, without adverting to the principle of the deterioration of soil, that rose-tree roots lose the smaller fibres by which they feed, and this, we have no doubt, is because these small roots are starved by the exhaustion of nutriment in the soil, poisoned by excrementitious contamina, or both.—(*Descriptive Catalogue of Roses for* 1835.)

Similar removal every three or four years, is indispensable in the culture of the raspberry, to insure successful crops. This, indeed, is one of the plants which was first observed in this country to deteriorate the soil, a circumstance indicated by the darker colour of the earth when the roots are dug up.—(*Quart. Journ. of Agriculture*, iv. 657.)

In the case of the gooseberry, the currant, and fruit trees in general, as other circumstances render it impossible to remove the trees into fresh soil, good cultivators have recourse to the inferior, but still useful substitute, of renewing the soil around the roots, or digging in manure.—(*G. Lindley's Guide to the Orchard*, passim.)

Offsets or Runners.—One of the best known examples of offsets or runners, occurs in the strawberry in all its numerous varieties which the old plants send off in every direction in great profusion, during the greater part of the summer and autumn, giving as plain an indication as if it were written in words at length, that the mother plant wishes to escape from the deteriorated soil. The older the plants, indeed, the greater number of runners they will send off, and, of course, the less fruit they will bear; because, according to the general inference already drawn, plants in general do not endeavour to diffuse themselves equally both by fruit or seed, and by suckers or runners. Growers of strawberries know this so well by experience, though not aware of the final cause, that, in order to increase their

crops of fruit, they check the extension of runners by cutting them off.

Strawberries are usually said, in practical works on gardening, to be biennial or rather triennial in bearing fruit; but this is probably a mistake, arising from the rapidity with which they deteriorate the soil: on the contrary, the crown which bears fruit is most probably annual, and it is only the new crowns formed by the side of this, that produce the second and the third year's crop, and would no doubt continue to bear from the accumulating crowns, were the soil not deteriorated.

It is remarkable, that not only the old plants send off runners, but even the young plants on the runners begin, sometimes before they are rooted, to send off runners also, as if they could not otherwise escape far enough from the soil deteriorated by the mother plant; or as if, from the moment they caught root, they commenced deteriorating the soil so rapidly, as to render immediate escape indispensable.

The violet is another instance of a plant sending off numerous runners, which root somewhat differently from the strawberry; though I introduce it here not on that account, but because practical gardeners have lately discovered it to be a great improvement in planting some of the species, to *wash* the roots clean, in preference to the usual mode of taking them up with balls of the soil. The violet, like the strawberry, must, according to our principles, be a rapid deteriorator of the soil, from the circumstance of its sending off runners to escape from it. The roots accordingly, taken up with the balls, in order not to check the growth when transplanted, must have around them the deteriorated soil, which the practical cultivator washes away empirically without being aware of the principle of deterioration. It is by no means improbable, that the same method of washing old strawberry roots and replanting them, might prove equally successful with the washing of the roots of the sorts of violets; and that it might be also applied to other sorts of plants, which indicate rapid deterioration of the soil, by sending off runners. A few well conducted experiments would decide this point.

The various species of violets, like several other genera of plants, differ, in some being annual and some perennial; and consequently, if our doctrine be sound, we ought to find cor-

responding differences in the mode of diffusion. The peculiarities of the species are indeed very remarkable, and, with respect to the point in question, most strikingly interesting. On the one hand, we have the perennial sweet violet (*Viola odorata*), the scentless violet of our woods (*Viola canina*), and the fragrant Ukraine violet (*Viola suavis*), sending off runners in profusion; while the cornfield violet (*Viola arvensis*), and the annual heart's-ease (*Viola tricolor*), diffuse themselves by seeds exclusively.

Now these annual violets probably deteriorate the soil as much as the creeping sorts, and hence, where they abound as weeds, their flowers are small and even minute, the whole plants look starved and sickly; while, if planted as garden flowers, as was occasionally done before the recent fancy for the large hybrid heart's-ease came into vogue, they bear flowers often three or four times the size of the chance weeds. Naturally, or rather providentially, then, these plants ought, on our principles, to be furnished with some efficient means of diffusion; and they are so, in the very remarkable mechanism of the seed-vessel, which we shall describe in detail.

The seeds of the annual heart's-ease are contained in a capsule or pod of a single loculament, consisting of three valves, to the inner part of each of which the seeds are attached, and remain so for some time after the valves, in the process of ripening, have separated and stood open. Through the influence of the sun's heat, the sides of each valve shrink and collapse, and in this state the hard smooth edges of the valve press firmly upon the seed, which, from being before apparently irregular in its arrangement, comes into a straight line. The seeds it may be observed, are not only extremely smooth, polished, and shining, but regularly egg-shaped, so that, when pressed upon by the hard collapsing edges of the valves, these slide gradually down the sloping part of the seed, and throw it with a jerk to a considerable distance. There is another part of the mechanism for the purpose of assisting the diffusion, which is worthy of notice. Before the seed is ripe, the capsule or pod hangs in a drooping position, with the persistent calyx spread over it like an umbrella, to guard it from the rains and dews, which would retard the process of ripening; but no sooner is the ripening completed than the capsule becomes upright, with the calyx for its sup-

port. This upright position is, no doubt, intended by Providence to give more effect to the valvular mechanism for scattering the seeds, as it thus gains a higher elevation of an inch or more, from which to project them. This, according to the laws of projectiles, will give it a very considerable increase of horizontal extent. The seeds are, in fact, thrown, in some instances, to the distance of several feet.

Nothing is more remarkable, on comparing the annual species which thus project their seeds to a distance with the perennial creeping species, than the difference of their shedding their ripe seeds. Being furnished in their offset runners with the means of escape, from the soil deteriorated by the mother plant, they have not, in addition to this means, any mechanism for scattering their seeds. They have, indeed, the same single loculament with its three valves, but these valves do not collapse upon the ripe seed, in order to throw it to a distance, and if they did, the distance would be necessarily small, from their not having, like the other, any mechanism for elevating the capsule, which usually hangs near the ground. Besides, the first flowers of the creeping violets, so much admired for their fragrance, are rarely productive of seed at all, and it is only the flowers which are produced in summer, nearly without petals, and rarely seen or remarked, that are succeeded by seeds, perhaps, because in very hot dry weather the whole plants, runners and all, being very liable to wither up and perish, the seeds are only then produced, that the species may not be thereby lost altogether. Whether all these inferences be strictly correct or not, I should be loth to maintain, but the facts stated are unquestionable, and appear to me to bear them out.

The old large-flowered garden heart's-ease (*Viola amœna*), as well as the now numerous hybrids produced by crossing this and the yellow heart's-ease (*Viola lutea*) and some others, is so rapid a deteriorator of the soil, that, though there cannot be a doubt of its being strictly perennial, many gardeners consider it as biennial, from its being so apt to die off when kept growing in the same spot, before the discovery of the washing the roots and replanting them in fresh soil was made. It is quite confirmatory of the views contended for, that these perennial species, which do not send off runners like the sweet violet, have

ctly the same mechanism for projecting the ripe seeds as the amon annual species.

It is by no means improbable, also, that other genera of plants, h as the garden-pink (*Dianthus hortensis*) and the sweet-liam (*Dianthus barbatus*), which are considered biennial, or perfectly biennial, might have their existence prolonged for eral years, without resorting to the usual mode of propaga-g, simply by washing their roots clean, and transplanting m immediately after they are out of flower.

Root-stocks.—The term root-stock (*Rhizoma*) is applied to at some botanists consider as an under-ground stem, as ha-g more the characters of a stem than of a root. Common amples of this in the dried state occur in ginger and in Flo-tine iris, and in the garden in the large blue iris. The prim-e has a similar root-stock, with the exception that it grows rpendicular, while the root-stocks, so called by botanists, nally affect a horizontal position, and, from extending hori-ntally, the newly formed root-stocks can escape to a greater stance from the soil deteriorated by the mother plant, than the w shoots around the crown of the primrose root.

The primrose, accordingly, not having the same facility of ffusion by fresh shoots, produces abundance of seed, while the ıe iris, which possesses this facility, rarely ripens seed. The mmon wood-sorrel (*Oxalis acetosella*) again, though its scaly ot-stocks lie in a nearly horizontal position, do not produce ıny new shoots, nor do these extend far from the mother ants; but diffusion is amply provided for by the mechanism the seed-vessel, which, by means of a projectile spring appa-tus, throws the seed about to as great distances as we have ready mentioned with respect to the heart's-ease. In the case, deed, of another species of wood-sorrel (*Oxalis corniculata*), is projection of the seeds around is apt to render it a weed, ıen it is introduced into gardens, or gets into corn-fields, as I ıve observed in Normandy, and the same, I am told, occurs in ıssex and in Devonshire.

Bulbs and Corms.—Two years ago, I planted early in spring e root of a spotted baldary (*Orchis maculata*) in a garden pot the size No. 48, and as these plants, whose flowers are little ferior in beauty to the hyacinth, are said to be difficult to cul-

tivate, I plunged the pot in a shady situation, similar to that where I had found the plant growing wild at Birchwood-corner, in Kent. It sent up a flower-stem exactly in the centre of the pot, and towards the end of summer the whole plant died down and disappeared, in the same way as a daffodil or a snowdrop. It was not disturbed in any way, to see whether it would live, and next spring it pushed up a head of leaves, though not in the centre of the pot, where the root had been originally planted, but at the very side of the pot, as if it had endeavoured to get away as far as possible from the soil deteriorated during the previous year's growth, and had been stopped in its progress by the side of the pot.

The progress of bulbs and corms, however, in diffusing themselves, must necessarily be limited and slow, even when no such obstruction occurs, inasmuch as the new bulbs or corms are for the most part in contact with the mother plant. But although such progress may appear necessarily slow, from this circumstance alone, the plants themselves, when left to nature, shew that how slow soever their diffusion may be, it is certain and efficient. The patch of baldaries, for example, from which I took the one referred to above, extended over a space of several roods of woodland, and must have originated some time or other in one or a few plants. A similar patch I have seen at Newbattle, near Dalkeith. In the same way, I have seen more than one very large patch of the common snowdrop (*Galanthus nivalis*), extending for many yards, and densely crowded, one on a bank near where Burnock Water joins the Lugar at Ochiltree, and another in the woods adjacent to Loudon Castle, near Galston. Whether these large patches of snowdrops were wild or introduced, I know not. Nor is it necessary to refer to those less common instances of the diffusion of bulbs and corms, since almost every wood furnishes similar examples, in the common blue bell or wild hyacinth (*Scilla nutans*), which is rarely seen solitary, or in twos and threes, but almost uniformly in very diffused patches.

The common chives or *syve*, to be seen in almost every cottage garden in Scotland, may furnish another obvious instance of the same effort towards diffusion, or escape from deteriorated soil. If a single bulb of chives, for instance, be planted in the

spring, so numerous a progeny of bulbs will be produced by it in a single summer, as to form a regular circular patch of about six or eight inches in diameter. The underground, or potato, onion, and the shallot, multiply on the same principle so rapidly, that they produce profitable crops to the growers.

Cultivators are so well aware of the soil being deteriorated by bulbs growing in it, that all the finer florist's flowers, such as hyacinths, tulips, and the various sorts of lilies, are taken up regularly and planted every year, or at least every other year, in fresh soil undeteriorated. In some instances, when these bulbs are not removed and replanted, they endeavour to get into undeteriorated soil, not by forming new bulbs at the sides of the old ones, but sending down an elongated bulb to the depth of several inches, while the old bulb in the shallower soil decays. I once found in this way, on the bank of the Ravensburn, in Kent, a bulb of the twin-flowered lily (*Narcissus biflorus*), no doubt an outcast from a garden, which had worked itself down to the depth of about two feet, and of course was able, on that account, to send up but a very weak stem.

In growing bulbs to a large size, as those of onions, by the ingenious method pointed out by Mr T. A. Knight, and those of flowering bulbs, in which the Dutch so much excel, it is found indispensable to have the soil not only rich, but free, in order to allow the root-fibres to extend beyond the sphere of the portion which they may have deteriorated. When the soil is not sufficiently free, accordingly, it requires to be frequently stirred. For the same reason, the bulbs require to be planted at such distances as that the root-fibres of one plant shall not reach and intermingle with those adjacent to it, otherwise the soil at their points of junction will be doubly deteriorated, and the plants must therefore suffer inconvenience, altogether independent of the deficiency of light and air, caused by overcrowding them.

When left to nature, bulbs and corms are enabled to modify the injurious effects of deteriorated soil, by annually shedding their root fibres, as deciduous trees do their leaves; and, consequently, even in the case of the old bulbs or corms, left in the ground, though no new ones be formed, the fresh root-fibres which push out at the season of growth, take, most probably, a different course from those of the previous year, to say nothing

of the resting of the ground for several months, and the influence which rain must have upon its interior.

Tubers.—Tuberous roots have, in some cases, a greater power of extension than bulbs, in others, scarcely so much, and hence, according to the principles contended for, the first sort must be inferred to indicate greater or more rapid deterioration than the second, to which last we shall first advert.

The Jerusalem artichoke may be taken as an example, of a tuberous-rooted plant, which does not extend far into the soil, and, accordingly, it is found in fact that it may be grown for years on the same spot without falling much off in quantity and quality, provided, however, that the soil suits it; for though it is of the easiest cultivation, and even is apt to become as troublesome a weed as horse-radish in most soils, yet there are places where it refuses to thrive, such as at Langley Park in Norfolk, while in the vicinity of Cork and of London, it grows with great luxuriance.

Tuberous-rooted flowers, again, which extend even less than the Jerusalem artichoke, such as the ranunculus and the dahlia, are found, by practical gardeners, to deteriorate the soil so much, that it is strongly recommended by all growers, never to plant them two successive seasons in the same spot, without at least thoroughly renewing the soil.

The *potato* is the most prominent, and by far the most interesting of the first sort of tubers, or those which possess considerable power of extending themselves in the soil around the mother plant. From the principles advocated, therefore, it ought to deteriorate the soil more than the ranunculus or the dahlia, whose powers of extension are greatly less. Now, though experiments on a small scale have led to the inference, that the potato does not greatly deteriorate the soil, the facts, demonstrated by extensive cultivation, prove the deterioration tobe very considerable, though it does not appear to be so very rapid.

Leaving out of consideration for the moment, the much agitated question of the recent failures in the potato crop, which I should be disposed to refer to the deterioration of the soil from cropping *in and in*, if the term may be allowed, I shall select a particular instance from Mr A. Gorrie, a well-known and accurate observer of facts connected with cultivation, and this in-

stance, it is worthy of remark, was given by the author apparently without the romotest idea of the inference I intend to draw from it, as his own inference is very different.

"In the year 1806," says Mr Gorrie, "I received a few of the variety since known by the name of the Perthshire Reds, from the late Dr Coventry, who, I was told, had the tubers from Ireland. They were recommended as being tolerably mealy, very prolific, and not liable to curl. In 1807–8, I introduced them to the 'Braes' of the Carse of Gowrie, where they yielded an extraordinary return; and although on analyzing, they did not contain quite so much nutritive matter as the ordinary variety, yet, from their vigorous healthy growth and prolific nature, they soon spread over the country, and the white flat variety disappeared. For ten years I cultivated the new variety in an early and dry soil, where potatoes are generally liable to curl, without perceiving the slightest tendency to that or any other disease, although I never changed tubers for planting. From the tenth to the fifteenth year of their culture here, they began to shew symptoms of curl, and the seed plums which, on their first introduction, were exceedingly numerous, began to be very scanty. To communicate fresh vigour, it was found necessary to change seed tubers from late and high to low and early soils. This, for some time, say two seasons, generally prevented the appearance of curl, but *if continued longer*, the whole field was infected; nor, even in the first year of the change, was there anything like the usual crop of seed-plums observable. Ultimately a taint or rot in the seed-tuber appeared in this and other *long-cultivated* varieties, and every method of pampering their decayed constitution was and is resorted to. Heating in pits is recommended to be avoided; but in days of yore, heating in deep masses did not affect their health. Early planting has been recommended, and yet the occupiers of early soils must go to late situations for seed-tubers. Planting without allowing the seed-tubers to come in contact with unfermented dung, has been resorted to, but erewhile this was reckoned wholesome practice. Planting when the soil is moderately moist is tried, but new and vigorous varieties succeed though planted when the soil is dry, whether newly cut or cut a month before planting, whether the dung be fresh or fermented, whether the tuber has been moderately or well ripened, or whether they may have been preserved in pits in the ordinary way or preserved with greater care." (*Quarterly Journal of Agriculture*, vii. 584.)

To me this seems to be as plain and direct evidence of overcropping with potatoes as could be given, but a favourite theory has so powerful a tendency to influence reason, and to warp facts to its own purposes, that hundreds might read the statement and never think of the soil. The intelligent author himself, instead of referring to the soil, ascribes the falling off in the crops to the potato, or rather to the peculiar variety degenerating, on the principle, we presume, advocated by Mr T. A. Knight, if it did not originate with him, that plants, like animals, have each a limited period of existence. Mr Knight, indeed, in the *Hor-*

ticultural Transactions, recommends new varieties of the potato to be raised from seed successively, to replace the varieties which he considers to be verging towards old age and consequent decrepitude. But lest I should be thought to misrepresent this doctrine, I shall give Mr Gorrie's own words:—

"That old age," he says, "may have overtaken many of the varieties of potato long since cultivated in this country, and long since lost, is proved by such varieties having long disappeared."

The facts which I have quoted from Mr Gorrie with respect to the Perthshire reds, are corroborated more or less by others of similar import, given in the "Report on the Failure of the Potato Crop," in the *Transactions of the Highland Society*, vol. xi. while other facts are there stated, quite contradictory both to the facts and the inferences. The most remarkable of these facts which appears to have been overlooked by the able reporter, is given by Mr Thomas Reid of Monkton Miln, Ayrshire:—

"Although," says Mr Reid, "by changing the seed, I can still grow an average crop of potatoes, yet, when raised, almost one-half of them are affected with a disease that renders them unfit for use. This disease is called the black or dry-rot, and has been long known in this neighbourhood, but its effects are becoming more generally felt over the country, as it is now observed on many farms where it was never known before, and *every succeeding season* THE POTATOES ARE GROWN ON THE SAME LAND, THEY SHEW THE MORE OF THE DISEASE. Instead of potatoes, I now grow turnips, but in the Swedish I have *for several years* observed the same or a similar disease." (P. 49.)

To me, it appears altogether unaccountable, that any one, from this statement and others very similar to it, should infer the degeneracy of the potato and entirely overlook the deterioration of the soil, which is, out of all question, the most prominent circumstance both in the statement of Mr Gorrie and of Mr Reid.

The inference of degeneracy in the potato itself, is expressly rejected by Mr David Dick of Dalquharran, who says, "I own I cannot discover the slightest ground from any thing I have learned of the potato, to say, that it has any tendency to become worse under ordinary culture in this climate," while he adduces proofs of the failure of new sorts only the fourth year from seed. Sir Alexander C. M. Gibson, Bart. of Clifton Hall, again states, that his predecessors had planted the same variety of potato for seventeen years, and he himself after them, for between forty and

fifty years, *in the same ground* and with the same management, with always fine crops.

"In summing up," says the Report, "the results of the opinions given by the previous twelve writers, we find considerable difference of sentiment regarding the fact of deterioration, and still greater regarding the safety or expediency of employing the remedy of renewing from the apple. Three among them seem to say there has been a general deterioration; one confines the failure to the Perthshire reds; another, while he speaks of a general failure, excepts peremptorily the kind called *cups;* while two very experienced persons are as decidedly opposed to the idea of there being *any tendency* in the potato to wear out with ordinary treatment, and one of these presents us with an instance of a potato constantly planted and replanted in his own ground for sixty-five years, and this the only kind which did not fail him during the recent years of failure; another again says, that the theory of deterioration was broached previous to 1792, at the time when the *curl* was as prevalent as the *dry-rot* is now, whereas he never heard of the *curl*, until the remedy now proposed of cultivating from the apple was adopted, and these, incautiously selected, were, he believes, the real cause of the introduction of the curl; four recommend a careful selection of the apples; one, to go to the original of the potato to be found in subsoils; three have found a careful selection of the apples succeed; three have found potatoes recently from the apple fail. What deduction can be drawn from such conflicting testimonies? Why truly,—*caution* in the use of a doubtful remedy, which requires much skill, in order not to aggravate the evil; and, perhaps, it may be added, that it may be worth while to give a fair trial to some of the other sanative and preventive methods which have been suggested in previous sections of this report, before resorting to what may be considered an extreme remedy."—p. 510.

The striking want of agreement in the statements must be admitted to render them, at the best, extremely suspicious, not with respect to the facts, in which there can be little doubt, but in the deductions. It appears to me, that they may all be easily reconciled by referring to the deterioration of the soil, rather than to the degeneracy of the sorts cultivated. In this point of view, it is much to be regretted, that the *Report* does not furnish us with specific and distinct data, and that the Society's queries did not contain one framed in such a manner as to elicit the requisite information. The only one bearing on the point is the twelfth, namely,—"After what crop in the rotation were your potatoes planted?" but the *Report* does not give a summary even of the answers to this. Appended to this query, there ought to have been another,—"How frequently, and for how long a period, have potatoes been planted on

the same piece of ground?" Unfortunately, I am unable to supply the facts required, at least with that exactness which the importance of the subject demands; but I may state one particular and one general instance, which will fully bear out the view contended for.

In the manufacturing village of Catrine, in Ayrshire, are a number of contiguous cottage-gardens, occupying several acres, lying on a rather steep slope with a southern aspect, and of course well exposed to the sun. From the time the cottages were built, some sixty years ago, these gardens were cropped year after year with potatoes, to the extent of more than two-thirds of the whole ground, manured from the usual dunghill, that, with utter disregard to cleanliness, was originally contrived to disgrace the front of each cottage. The manure, consequently, consisted chiefly of coal-ashes, soaked with soap suds and other slops, and sometimes with potato-haulm, fern-leaves, and other vegetable refuse, collected by those who were anxious to increase their quantity of manure. Up to about the end of the last century, by means of this manuring, and by alternate crops of kale, cabbage, and other garden-vegetables, a tolerable return of potatoes was produced in the gardens. The sorts cultivated were the long winters, the blues or purples, and the pink-eyes or dons.

In from a dozen to twenty years after the first garden-crops were taken (with the previous history of the ground I am unacquainted), the villagers began to discover that the potatoes fell off very much both in quantity and quality,—the returns being scanty, and the whole small, scabbed, and bad flavoured. This falling off increased so much, that the more careless occupants left the potato portion of their gardens untilled, while several of the more industrious sowed oats, on the portions not occupied with kale and other vegetables. This intervening crop, and, no doubt, the full exposure of the ground to the influence of the southern sun, tended in some measure to renovate the deteriorated soil; and potatoes, when again tried, yielded a much better return.

These facts, which may be fully depended on, let the inferences from them be what they may, furnish a strong counter-statement to that so often met with in books, of gardens being kept in cultivation for ages without any falling off in crops,—a circumstance, indeed, altogether impossible and incredible

under any plan of manuring, if there be no rotation nor renewing of the soil by fresh earth, either from a distance, from trenching a spit and a half or two spit deep, or by burning, which is the most efficient renovator of all others. It is much to be regretted that in the statement of Sir A. Gibson, above quoted from the *Report*, though he says his potatoes were grown "*without any change whatever* either in management or *in the ground*," that he does not say whether the same piece was successively cropped with potatoes, or in rotation with other crops; and, if the latter, what intervals occurred between the crops of potatoes. From these important circumstances being omitted, I cannot, on my principles, draw any inference whatever from his statement.

The general instance, to which allusion was made above, I take from the cultivation of the potato in Ireland. The Rev. Dr Townsend, speaking of the potato, says, "Certain it is, that Ireland is the first European country where its real virtue, if not soonest known, was soonest extensively applied. It may be added, also, that *in few countries does it attain equal, and in none greater, perfection*."—*Quart. Journ. of Agriculture*, i. 322. Now, though this was most probably true many years ago, it is so far from holding at present, that I believe the very contrary is the case. I speak from my own experience when I say that I have never, in any part of Ireland, from the Giant's Causeway to Bandon in the county of Cork, tasted any potatoes of even average goodness, when compared with those of France, Germany, or Switzerland, or even with those of Scotland, or the best in England. The best Minions I ever saw at Cork had an earthy disagreeable flavour, which is not at all common in any potatoes out of Ireland. What the commoner and inferior varieties must be when the best are so bad, I leave the reader to judge. So much for the qualities of Irish potatoes.

The quantities of potatoes produced in Ireland may be fairly judged of from the recent and numerous failures of the crop, and the distressing famines consequent thereupon,—failures which seem to be rapidly extending in all the poorer countries, such as the Highlands of Scotland, where the land has been overcropped with potatoes. In many parts of the Highlands there are only limited spots of arable land where the potato

can be grown, such as the small holms by the sides of streams, or the bottoms of the richer glens, such as Glendarnel in Argyleshire, and where the rotation is chiefly confined to oats and potatoes, as is most usual, the effects must be obvious,—namely, rapid deterioration in spite of the best management as to ploughing and manuring.

The same effects are produced in Ireland, not from the spots of arable land being small and limited, as in the Highlands, for there are in Ireland extensive tracts of excellent soil; but from the smallness of the tenements and the overcropping which is the consequence, inasmuch as potatoes being the staple food of the inhabitants, a large proportion of every little farm (and nearly all the farms are very small) is annually cropped with potatoes. It is not at all wonderful, therefore, that the potatoes should be of inferior quality, and unproductive in quantity; for, if the principles advocated in this paper be only in part correct, the wonder would be to see crops of even average goodness.

A similar fact has been mentioned to me by a gentleman fond of agricultural study. The farmers in Essex have, for a considerable period, been in the practice of growing large quantities of potatoes for the London market, and of course must repeat the crop frequently on the same ground, though I am not acquainted with the rotation which they follow. Latterly, however, they have found that they cannot obtain such crops of potatoes as were wont to be produced, no doubt, from the same causes that we have shewn must have operated in the cottage gardens at Catrine, and in Ireland, and the Highlands of Scotland.

It would, I perceive, be impracticable to discuss this important subject with all the requisite details, so as to enter into the two distinct circumstances of exhaustion and of deterioration of the soil, or both combined, with reference to the potato, in the limits of the present paper, even if I possessed, as I do not at present, facts sufficiently well ascertained to ground conclusions upon. I hope I have brought forward enough to excite attention to the subject, and probably to induce some one better able than myself to do it justice. In the mean while, I cannot terminate this part of the subject without adverting to the interesting circumstances of the variety of opinion respecting whole and cut sets, and of the effects produced on the soil by one species or variety, with reference to another species or variety.

As one stem will rise from every eye or bud of the potato tuber, and would therefore produce more stems crowded together than could find room to grow, it has been found preferable to cut the tubers so as to leave one eye or bud with a piece of the potato, thick enough to nourish the stem till it get well above ground. It was, in fact, proved by experiments at the Horticultural Society's Gardens near London, that cut sets are greatly preferable for planting to the entire tuber; nay, that cuttings with only one eye are a fortnight earlier than when two eyes are left.

On the contrary, the answers to the queries returned to the Highland Society almost all agree that the cut sets are greatly more liable than the entire tubers to be affected with the rot. Mr Rankine of Kilsyth, for instance, says, "In all the examinations I have ever made, I never found a whole or uncut potato die of the rot." Captain Montgomerie again says he has heard of no failure where whole potatoes have been used as seed; and Mr Blacker says, it is a general opinion "that whole potatoes are more certain than cuttings."

The conclusion which I am inclined to draw from these facts, is, that the deteriorated soil exerts more readily and rapidly its injurious effects on the cut sets than on the entire potato. In the London Horticultural Experiments, it is presumed that the soil in which the sets were planted had not been previously cropped with potatoes, and, therefore, they succeeded better than the entire tubers. Whereas, on the other hand, the soils referred to in the Highland Society's *Report*, may be fairly presumed to have been frequently cropped with potatoes; some of them so frequently as to have become greatly deteriorated.

In the case of the uncut tubers being planted, the first shoots from the eyes are supported by the nourishment stored up in the tuber itself, for a considerable time before any root-fibres are pushed into the soil in search of food from the soil itself. The stems, therefore, acquire considerable vigour before they have to depend on any of the injurious materials contained in the deteriorated soil; and, in consequence of such vigorous growth, the root-fibres subsequently pushed out, must be vigorous in proportion, and, of course, not so delicate nor liable to be injured as they would be in an earlier stage of their growth.

The cut sets, on the other hand, having but a limited portion of nourishment to supply to the young plant, it is indispensable to its growth that root-fibres be sent in quest of food at a much earlier stage of growth, while the plant is still feeble and delicate. Nay, frequently, the nourishment in the cut set is quite exhausted by the shoot from the eye, before the young plant gets above ground and before root-fibres are formed ; and, in such cases, the whole dies of what is termed the dry-rot. Most of the preventive expedients resorted to as detailed in the *Report* refer to this exhaustion of the nutritive matter in the cut set, in consequence of dry soil, dry weather, or drying too much before planting. But here the soil being undeteriorated by overcropping with potatoes, such expedients would, in most cases, be unnecessary, as the feeblest root-fibres would, in that case, be sufficient to bring the plants forward.

Another circumstance, it appears to me, may contribute to injure the cut sets when they are not so much exposed to exhaustion of their nutritive materials by being kept too dry. The cut surface when fresh, or when the ground is moist, will, there can be no doubt, readily imbibe moisture from the soil in which it is planted. Now, if this soil has been deteriorated by previous overcropping with potatoes, the moisture so imbibed cannot fail, on the principles advocated, to prove injurious, and hence it is highly probable the origin of the *wet rot* or putridity. " From the first planting," says Mr Robert Gray, " putrefaction may be seen to have commenced on the cut surface of the seed, and, in about eight days or more, it will be one mass of rottenness." He adds, " The young shoots, however, will be coming away in the mean time, and, when the circumstances are favourable to its growth, may have attained a strength sufficient to render it independent of the decayed seed,"—a very remarkable corroboration of our doctrine, deduced, not from principle, but from fact.

One of the preventive expedients noticed by the writers in the *Report*, is, to procure seed-potatoes, from a different soil and situation to the one they are to be planted in ; and this also may be explained from the circumstance of deteriorated soils. There is no fact better ascertained in agriculture, than that one species of crop will either benefit or injure the succeeding crop

according to the nature of that species. Wheat, for example, is benefited by a previous crop of turnips, while it would be injured by a preceding crop of flax or hemp; and no farmer in his senses would think of making one or two crops of wheat succeed each other without the intervention of turnips, summer fallow, or the like. Now, what holds good of different species may hold good of very marked varieties of that species; and probably bearded wheat might be sown after the awnless variety, with much less disadvantage than if the same variety were continued in the same field.

Something of this sort, corroborative of the views just suggested, seems to occur with respect to the varieties of the potato. "At the commencement of the present century," says Mr Gorrie, "a flat white potato was in general field-culture, and possessing qualities not equalled by its successors in this country,—the 'Perthshire Reds.' This flat white potato, in the last years of its culture, became sickly, and on early soils very liable to curl." He adds, "the Perthshire Reds soon spread over the county, and the white flat variety disappeared." (*Quart. Jour. of Agri.*, vii. 583.)

Now, I am disposed to infer that this white variety which disappeared, because it was liable to curl, and be unproductive, was of the nature of a species, and so different from its successor, that the soil deteriorated by the first, had not so much injurious effects on the second, as it had on the first. In the same way, the effect of different soils seems to be to alter the constitution of any given variety so much, that when transferred to other soils, it takes the character of a new variety. "Persons," says Mr Rankine, "when selecting seed, should be at the trouble to go in the month of July, which is the proper time for selecting it, to moorish, high-lying, and retentive tracts of country, *where the plough has been more sparingly used than in the more fertile parts*, and see the potatoes growing, in order to judge which to prefer."—(*Report*, p. 495.) That is, the seed-potato should be selected from lands, which have not been previously overcropped with potatoes; nay, I have little doubt that, were it possible always to select such as had been grown in maiden soil, much of the evils complained of would be prevented, even in soils which have been deteriorated by overcropping. For the potatoes grown in a maiden soil would contain none of the juices derived from a deteriorated soil, and would be more vigorous, and capable of withstanding its injurious influence.

But, though different species and varieties may, and sometimes do, thrive better in the same land, than if the same species or variety were successively planted; yet this principle ought not to be acted upon, when circumstances render it practicable to make greater changes. The deterioration contended for, indeed, very frequently extends to species and varieties much more nearly allied than the two sorts of wheat above alluded to, or than the several varieties of the potato. Some leguminous crops are of such a nature, it would appear, if the facts are to be depended upon (for I cannot, in this case, avouch any thing from my own observation), that they deteriorate the soil, from bearing other leguminous crops of a similar kind. Dutch or white clover, for example, a perennial plant of great value in permanent pasture, is strongly asserted to deteriorate the soil from bearing red clover, an equally valuable biennial.

"About forty or fifty years ago," says Mr Joseph Russell, "Lines was the only person in the parish (Ashaw, near Warwick) that sowed white or Dutch clover; and yet the different fields are now to be traced to the former occupier by the white clover crop. I have, within the last year, frequently been through the parish, and have as often remarked the various appearances of the clover fields. The last year I was induced to watch the seeding and progress of two of these fields, which are now in the occupation of Mr Dormer. They adjoin each other, the land is of nearly the same quality, and they have been cropped and treated alike for the last twenty years. The clover came up in both fields alike; and, turning a fine healthy plant, continued to bear the same appearance until the first week in March, when the plant in one field lost its healthy verdure, and the leaf turned blue and yellow, and I imagined that some of the plants had disappeared. It was then stocked with sheep.

"A month had nearly elapsed before I crossed these fields again after I had remarked this alteration; they were then stocked with sheep, horses, and cattle; and, though one remained in full healthy plant, the other had ejected almost every plant of the red clover. On making inquiry, I found that the field where the red had failed had been saturated with white clover a much longer time than the other, and that I had good reason to conclude was the cause why it could not retain the red clover plant.

To the following questions which I put to William Lines, an elderly person who had never lived out of the parish, he gave me the annexed answers:—

"Q. When you were a youth living with your father, do you remember his mode of mixing his grass-seeds?

"A. He sowed ryegrass and red and white clover: he was very partial to the latter, and sowed a great deal of it.

"Q. You frequently see those fields which were occupied by your father, What are the crops of artificial grasses now?

"A. They grow plenty of ryegrass and white clover, but no red; yet all the farmers get some good red on other lands.

"Q. As long back as you can remember, can you make any remarks on this subject?

"A. My father was the only person in the parish who sowed Dutch clover; he used to blame others for not sowing it."—(*Practical and Chemical Agriculture*, p. 113, 8vo. Kenilworth, 1831.)

Mr Russel is therefore of opinion, "That white clover is a noxious weed on all land intended to be kept in tillage, as it has supplanted, in a great measure, and will supply, if not discourage, the place of a better plant, and rob the soil of that property which would support one of a much more valuable description." He adds, "The red alone may be sown so close in succession, that it will exhaust the powers of the soil so much that it will not retain it."

Mr Towers states, with respect to another leguminous crop, that, in the shallow loamy soil of the Isle of Thanet, the farmers are so well acquainted with the injurious effect, as to use the term *over-pea'd* for overcropping with pease, which so poisons the soil, that "if pease be again planted, though they rise from the soil, they soon turn yellow, are '*foxed*,' and produce nothing of a crop." (*Quart. Journ. of Agriculture*, iv. 658.)

I ought now to proceed, in due order, to go over examples of annual plants, as I have just done with perennials, adverting to the interesting subject of *Artificial Grasses* and *Corn Crops*, as illustrative of the doctrine of deterioration; and I ought also to go at length into the nature of the deterioration itself, whether that arise from *exhaustion*, as is usually believed, or from *contamination*, as some have recently maintained; or from both together, which appears to be most probable. But as I have not room, within the limits of a paper, for subjects of such interest, I must reserve them for some future opportunity.

J. R.

ON SOUTHDOWN SHEEP AS BEING WELL SUITED FOR THE MIDDLE RANGE OF HIGHLAND PASTURES IN SCOTLAND.

By Mr H. Watson, Keillor Farm.

Having, during the last twenty-five years, been in the management, or possession, of a considerable breeding flock of Southdown ewes, varying at different times from 500 to 1000 in number, and during that period have had good opportunities of drawing close comparisons betwixt that and the other breeds of mountain sheep, viz. the Cheviot and Black-faced, I have come to the conclusion (and am acting upon it in my own practice), that from a pasture ranging from 500 to 1200 feet above the level of the sea, having a moderate portion of green sward, the rest whin and heather, there can be no more profitable stock of sheep kept, than a flock of Southdowns of the best sort. My chief reasons for having preferred this breed are:—that the Southdown sheep, although naturally a spirited and active animal, are easily controlled and managed by a good shepherd,—can go over more ground for their food than any other kind of sheep, without stopping their growth,—and when tried by severe storm in winter, will brave it better than even the Black-faced Highland,—and although reduced very low in spring, sooner pick up condition, than the other short-woolled sheep. As a proof of the Southdowns' inclination to fatten, when put to good keep, I may mention a fact, that while I have seldom been able to produce a fat Cheviot ewe the same season she has reared a lamb, I never fail to make good fat of the cast Southdowns *off grass.* Their wool is so closely matted on their backs, and about the head and neck, as to be almost impervious to rain or snow; hence, so soon as the storm ceases, they appear dry and comfortable, their coat not the least disordered, and altogether free of that *droukit* (Anglicè drenched) appearance, which longer woolled sheep exhibit, even for days, after a winter storm.

In all my experience, the Southdown sheep have kept remarkably healthy. I have never seen an instance of rot in my flock, while, during the last twenty years, I have been forced to clear off a lot of Cheviot and also of Black-faced ewes, from that in-

curable disease. This, however, may have been more owing to the unsoundness of the pasture from which I got them, than from any peculiarity in the constitution of the animals themselves.

My average loss in the Southdown lot has invariably been much under that of any other sheep I have bred; they are hardy and easily managed at lambing time, affectionate mothers, and on moderate keep give a great quantity of milk, and if there is any inducement for having early lambs, they will go with the ram, almost as soon as the lamb is weaned.

When crossed with a well-bred Leicester ram, and brought into good keep, they produce, perhaps, the most profitable lamb that is bred, taking wool and carcass into account. I have for the last ten years put all the ewes I could spare from pure breeding to this sort of crossing, lambing the ewes on turnips in spring, then turning them, as soon as the season would permit, to the hill pasture (the Sidlaws) till weaning time, when the lambs are brought to the infield pastures, and put to turnips for the winter, on which food they are kept for about 2d. per week each, and placed on the earliest grass in spring, so that within a month or six weeks after they are clipped, they are fit for the butcher, who values this cross almost as high as the pure bred Southdown. The wool is of the finest quality for combing, and fetches the highest price of any British grown wool, generally from 2s. to 2s. 2d. per lb., and the clip will in a good season average about 6 lb. At sixteen months old, I have never realized less than 40s. each, wool and mutton. In Smithfield this cross is much sought after.

On lands where folding is found necessary, the Southdown submits to this treatment better than any other breed of sheep; indeed, such in all cases where I have put them to the test, is their spirit and hardiness, that nothing short of *ill treatment* seems to injure them.

Combining these facts, I can have no hesitation in recommending a Southdown flock of sheep in preference to every other, on such situations as I have described, viz. *too high to be occupied during the whole season by a flock of Leicesters, and under that level which the native Black-faced sheep* only *can thrive upon.*

So far as I know, it is not yet sufficiently ascertained by experience, how far a cross betwixt the Southdown and Leicester may be carried, so as to keep up the activity of the former, with the well-known fattening qualities of the latter. Another strain of breeding through the Black-faced and Southdown sheep, whose habits are so much akin, seems likely to succeed. By this cross, improvement in quality of wool would be gained, while that of the mutton would not be deteriorated. I have at present some experiments going on, which I trust will go far to determine these points. When finished, I shall be glad to communicate the results to my brother breeders, considering it a duty every British farmer owes to his country, to make known whatever he conceives may be for the general good, or that may in the smallest degree tend to keep up the proud position we now stand in as a body, feeling it can only be by combined efforts this position can be maintained, laying aside all selfish and narrow-minded jealousies.

ON THE DISEASES INCIDENTAL TO THE MOST USUALLY CULTIVATED PLANTS.—NO. III.

By George W. Johnson, Esq., Corresponding Member of the Maryland Horticultural Society, &c.

Canker.—Whatever may be the disease under which a plant is suffering, it is too usual for the cultivator to confine his attention to the part immediately affected. It is looked upon as a strictly local derangement, and the remedies are as erroneously topical. To consider that because a bud, a branch, or a root are diseased, that the cause of the distemper is to be sought for there, is as sensible as supposing that every local pain endured by the human frame arises from a disorganization of that part. On the contrary, we know that the diseases of animals arise almost universally from the stomach, and, as Addison remarked, "that physic is generally the substitute for temperance or exercise." The functions of the stomach, by whatever cause deranged, render digestion imperfect, and the secretions defective; the bile is superabundant or deficient in quantity, and headach

is the result; the liver is diseased, and it causes a pain the most acute between the shoulders; the blood is ill elaborated, and eruptions are thrown out on the surface of the body. With plants it is the same. It may be laid down as an axiom, without exception, that all vegetable diseases, unpreceded by external violence, arise from the unhealthful state of the sap,—a state brought about conjointly or separately by the improper food imbibed, and the deranged digestive power of the leaves and other organs. That this is so will not appear strange, when we reflect that from the sap all the parts of the plant are formed, and continually are increased in number and size. The solid substance of the wood, and the temporary tender blossoms, are alike extracted from that circulating fluid. If the constituents for these are wanting, or if improper components are introduced, disease is the necessary consequence. Disease, which in youth and manhood usually arises from intemperance and over-excitement, visits old age as a consequence of its decayed vital powers; and "if the silver cord has not been loosed," or "the golden bowl broken" by the short-sighted indulgence of early years, man gradually declines into the grave, as the vital organs cease to perform their office, because the limit of existence natural to his species has been attained. Some diseases peculiar to old age are prematurely induced in the usually vigorous period of life by licentious indulgences, individual or hereditary. Ossification of the vascular system is an example. In the vegetable part of the creation, the *canker* or *ulcer*, to which our apple, pear, elm, and other trees are subject, is a somewhat parallel instance. This disease is accompanied by different symptoms, according to the species of the tree which it infects. In some of those whose true sap contains a considerable quantity of free acid, as in the genus Pyrus, it is rarely accompanied by any discharge. To this dry form of the disease it would be well to confine the term *canker*, and to give it the scientific name of *Gangræna sicca*. In other trees, whose sap is characterized by abounding in astringent or mucilaginous constituents, it is usually attended by a sanious discharge. In such instances it might be strictly designated *ulcer* or *Gangræna saniosa*. This disease has a considerable resemblance to the tendency to ossification which appears in most aged animals, arising from their marked appetency

to secrete the calcareous saline compounds that chiefly constitute their skeletons. The consequence is an enlargement of the joints and ossification of the circulatory vessels and other parts, phenomena very analogous to those attending the cankering of trees. As in animals, this tendency is general throughout their system; but, as is observed by Mr Knight, "like the mortification in the limbs of elderly people," it may be determined as to its point of attack by the irritability of that part of the system. This disease commences with an enlargement of the vessels of the bark of a branch or of the stem. This swelling invariably attends the disease when it attacks the apple-tree. In the pear the enlargement is less, yet is always present. In the elm and oak sometimes no swelling occurs; and in the peach I do not remember to have seen any. I have never observed the disease in the cherry-tree or any of the pine tribe. The swelling is soon communicated to the wood, which, if laid open to view, on its first appearance, by the removal of the bark, exhibits no marks of disease beyond the mere unnatural enlargement. In the course of a few years, less in number in proportion to the advanced age of the tree, and the unfavourable circumstances under which it is vegetating, the swelling is greatly increased in size, and the alburnum has become extensively dead; the superincumbent bark cracks, rises in discoloured scales, and decays even more rapidly than the wood beneath. If the caries is upon a moderately sized branch, the decay soon completely encircles it, extending through the whole alburnum and bark. The circulation of the sap being thus entirely prevented, all the parts above the disease of necessity perish.

In the apple and pear the disease is accompanied by scarcely any discharge; but in the elm this is very abundant. The only chemists who have examined these morbid products are Sir H. Davy and Vauquelin, the former's observations being confined to the fact, that he often found carbonate of lime on the edges of the canker in apple-trees (*Elements of Agric. Chemistry*, 2d edit., p. 264).

Vauquelin has examined the sanies discharged from the canker of an elm with much more precision. He found this liquor nearly as transparent as water, sometimes slightly coloured, at other times a blackish-brown, but always tasting acrid and saline.

From it a soft matter, insoluble in water, is deposited upon the sides of the ulcer. The bark over which the transparent sanies flows attains the appearance of chalk, becoming white, friable, crystalline, alkaline, and effervescent with acids. A magnifier exhibits the crystals in the forms of rhomboids and four-sided prisms. When the liquid is dark-coloured, the bark appears blackish, and seems as if coated with a varnish. It sometimes is discharged in such quantities as to hang from the bark like stalactites. The matter of which these are composed is alkaline, soluble in water, and with acids effervesces. The analysis of this dark slimy matter shews it to be compounded of carbonate of potass and ulmin, a product peculiar to the elm. The white matter deposited round the canker was composed of

Vegetable matter, ...	60.5
Carbonate of potass, ...	34.2
Carbonate of lime, ...	5.0
Carbonate of magnesia, . . .	0.3
	100.0

Vauquelin calculated from the quantity of this white matter that was found about the canker of an elm, that 500 lb. weight of its wood must have been destroyed (Annales de Chimie, xxi. 30). There is no doubt that such a discharge is deeply injurious to the tree, but the above learned chemist appears to have largely erred, for he calculated from a knowledge of the amount of the saline constituents in the healthy sap, whereas in its diseased state these are much and unnaturally increased. I once was of opinion that this disease does not arise from a general diseased state of the tree, but that it is brought on by some bruise or injury, exasperated by an unhealthy sap, consequent to an unfavourable soil, situation, and culture ; but more extensive and more accurate examinations convince me, that the disease is in the tree's system ; that its juices are vitiated ; and that disease will continue to break out, independent of any external injury, so long as those juices continue peccant and unaltered. This conclusion will be justified, I think, by the preceding facts, as well as by those distributed through the following pages.

The disease is not strictly confined to any particular period of the tree's age. I have repeatedly noticed it in some of our lately introduced varieties that have not been grafted more than five

or six years; and a writer in the Gardener's Magazine (vol. v. p. 3) states, that the trees in his orchard, though "only of four years' growth, are sadly troubled with the canker." Although young trees are liable to this disease, yet their old age is the period of existence most obnoxious to its attacks. It must be remembered, that that is not consequently a young tree which is lately grafted. If the tree from which the scion was taken is an old variety, it is only a multiplication of an aged individual. The scion may for a few years exhibit signs of increased vigour, owing to the extra stimulus of the more abundant supply of healthy sap supplied by the stock; but the vessels of the scion will, after the lapse of that period, gradually become as decrepid as the parent tree. The unanimous experience of naturalists agrees in testifying that every organized creature has its limit of existence. In plants it varies from the scanty period of a few months, to the long expanse of as many centuries; but of all, the days are numbered; and though the gardener's, like the physician's, skill, may retard the onward pace of Death, he will not be permanently delayed. In the last periods of life they shew every symptom that accompanies organization in its old age—not only a cessation of growth, but a decay of former developments, a languid circulation, and diseased organs.

The canker, as already observed, attends especially the old age of some fruit trees, and of these the apple is most remarkably a sufferer. "I do not mean," says Mr Knight, "to assert that there ever was a time when an apple tree did not canker on unfavourable soils, or that highly cultivated varieties were not more generally subject to the disease than others, where the soil did not suit them. But I assert, from my own experience and observation within the last twenty years, that this disease becomes progressively more fatal to each variety as the age of that variety, beyond a certain period, increases; that all the varieties of the apple which I have found in the catalogues of the middle of the seventeenth century, are unproductive of fruit, and in a state of debility and decay." (Some Doubts relative to the Efficacy of Mr Forsyth's Plaster, by T. A. Knight, Esq., P.L.H.S. &c. 1802.)

Among the individuals particularly liable to be infected are those which have been marked by an excessively vigorous growth

in their early years. I have in my garden at Great Totham a maiden standard peach, which is now about sixteen years old. The size and abundance of its annual shoots, until within the last quarter of its existence, were unnaturally large. It is now grievously affected by *canker*.

Trees injudiciously pruned, or growing upon an ungenial soil, are more frequently attacked than those advancing under contrary circumstances. The oldest trees are always the first attacked of those similarly cultivated. The golden pippin, the oldest existing variety of the apple, is more frequently and seriously attacked than any other.

The soil has a very considerable influence in inducing the disease. If the subsoil is a ferruginous gravel, or if it is not well drained—if the soil is aluminous, and effective means are not adopted to free it of superabundant moisture—the canker, under any one of these circumstances, is almost certain to make its appearance among the trees they sustain. If an old worn-out orchard is replanted with fruit-trees, the canker is almost certain to appear among them, however young and vigorous they were when first planted.

How inducive of this disease is a wet retentive subsoil, if the roots penetrate it, appears from the statement of Mr Watts, gardener to R. G. Russell, Esq., of Chequer's Court in Buckinghamshire. A border beneath a south wall had a soil three feet and a half in depth, apparently of the most fertile staple, twice re-made under the direction of the late Mr Lee, of the Vineyard, Hammersmith. In this the trees, peaches, and nectarines, flourish for the next three or four years after they are planted, but then are rapidly destroyed by the canker and gum. The subsoil is a stiff sour clay, nearly approaching to a brick earth; and the disease occurs as soon as it is reached by the roots of the trees (Gardener's Magazine, vi. 617). Mr Forsyth concluded that the soil is not always the source of the disease, because it universally and invariably appears at first in the branches, and proceeds thence towards the roots of the tree. But this is certainly a conclusion not warranted by the premises, because the acridity of the sap, whatever may be its source, would be likely to injure and corrode, in the first instance, those parts where the vessels are the most weak and tender; now

these, past dispute, are in the branches. Moreover, we generally see the youngest branches the earliest sufferers.

Pruning has a powerful influence in preventing the occurrence of the canker. I remember a standard russet apple-tree, of not more than twenty years' growth, with a redundancy of ill-arranged branches, that was excessively attacked by this disease. I had two of its three main branches removed, and the laterals of that remaining thinned carefully, all the infected parts at the same time being removed. The result was a total cure. The branches were annually regulated, and for six years the disease never reappeared. At the end of that time the tree had to be removed, as the ground it stood upon was required for another purpose. John Williams, Esq. of Pitmaston, from long experience, concludes that the golden pippin and other apples may be preserved from this disease, by pruning away every year that part of each shoot which is not perfectly ripened. By pursuing this method for six years, he brought a dwarf golden pippin tree to be as vigorous and free from canker as any new variety (Trans. London Horticultural Society, vi. Art. 64).

All these facts unite in assuring us that the canker arises from the tree's weakness, from a deficiency in its vital energy, and consequent inability to imbibe and elaborate the nourishment necessary to sustain its frame in vigour, and much less to supply the healthy development of new parts. It matters not whether its energy is broken down by an unnatural rapidity of growth, by a disproportioned excess of branches over the mass of roots, by old age, or by the disorganization of the roots in an ungenial soil; they render the tree incapable of extracting sufficient nourishment from the soil, consequently incapable of developing a sufficient foliage,* and therefore unable to digest and elaborate even the scanty sap that is supplied to them.

The reason of the sap becoming unnaturally saline appears to be, that, in proportion as the vigour of any vegetable declines, it loses the power of selecting by its roots the nourishment congenial to its nature. M. Saussure found in his experiments, that the roots of plants growing in saline solutions absorbed the most of those salts that were injurious to them, evidently because the

* No symptom of a cankered tree is more invariable than a deficiency of leaves.

declining plant lost the sensitiveness and energy necessary to select and to reject. Thus, when plants of *Polygonum persicaria* and of *Bidens cannabina* were grown in a solution containing *sulphate of soda* (Glauber salt), and *acetate of lime*, and *chloride of sodium* (common salt), they altogether rejected the *acetate of lime;* but, when grown in a solution of *sulphate of copper* and *acetate of lime*, they imbibed the latter abundantly. Now sulphate of copper M. Saussure found to be the most deleterious to the plants of all the salts, in a solution of which he plunged their roots.

Supposing the portion of salt originally in solution to be 100, the proportions of each absorbed were as follows:—

Chloride of sodium, . .	10.0
Sulphate of soda, . .	6.0
Acetate of lime, . . .	0.0
Sulphate of copper, . .	34.0
Acetate of lime, . . .	31.0

M. Saussure also found, that, if the extremities of the roots were removed, the plants absorbed all solutions indiscriminately. (Saussure's Recherches Chimiques sur la Vegetation, 260.)

An ungenial soil would have a debilitating influence upon the roots in a proportionate, though less violent, degree than the sulphate of copper, and as these consequently would absorb soluble bodies more freely, and without that discrimination so absolutely necessary for a healthy vegetation, so the other most essential organs of nutrition, the leaves of the weakened plant, would promote and accelerate the disease. These, reduced in number and size, do not properly elaborate the sap; and I have always found, that under such circumstances these stunted organs exhale the aqueous particles of the sap very abundantly, whilst their power of absorption is greatly reduced. The sap, thus deficient in quantity, and increased in acridity, seems to corrode, and affect the vascular system of the tree in the manner already described.

These facts afford us most important guides in attaining the desired objects, the prevention and cure of the disease.

If superluxuriance threatens its introduction, the best remedy is for the cultivator to remove one of the main roots of the tree, and for him to be particularly careful not to add any fertile ad-

dition to the soil within their range. On the contrary, it will be well if the continued exuberant growth shews its necessity for the staple of the soil to be reduced in fertility by the admixture of one less fertile, or even of drift-sand.

If there is an excess of branches, the saw and the pruning-knife must be gradually applied. It must be only trees of very weak vital powers, such as is the golden pippin, that will bear the general cutting of the annual shoots, as pursued by Mr Williams. A new vigorous variety would exhaust itself the following year in the production of fresh wood. Nothing beyond a general rule for the pruning can be laid down, and it amounts to no more than the direction to keep a considerable vacancy between every branch, and that above or beneath it; and especially to provide, that not even two twigs shall chafe against each other. The greater the intensity of light, and the freer the circulation of air among the foliage of the tree, the better the chance for its healthy vegetation.

If the disease, being in a fruit tree, is a consequent of old age, it is probably a premature senility, induced by injudicious management, for very few of our varieties are of an age that insures to them decrepitude. I have never yet known a tree, unless it was in the last stage of decay, that could not be recovered by giving it more air and light, by careful heading in, pruning, improvement of the soil, and cleansing the bark.

If the soil, by its ungenial character, induces the disease, the obvious and only remedy is its amelioration; and, if the subsoil is the cause of the mischief, the roots must be prevented striking into it. In all cases, it is the best practice to remove the tap root. Many orchardists pave beneath each tree with tiles and broken bricks. If the trees are planted shallow, as they ought to be, and the surface kept duly fertile, there is not much danger of the roots striking into the worse pasturage of the subsoil. On this point, the experience of Mr W. Nicol, the gardener at Newick Place, in Sussex, agrees with my own. He says the canker may be avoided in most instances by paying proper attention to the soil in which the tree is planted. Canker, he thinks, will seldom occur if the surface-soil is good, for in that case, the roots will never descend into the prejudicial subsoil, but spread out their radicles near the surface, where they find food most

abundant. If this is not kept up, the roots descend into the obnoxious substratum, and the disease assuredly follows. (Baxter's Library of Agric. and Hortic. Knowledge, 3d Edit. 22.)

It remains for me to detail the course of treatment I have always found successful in effecting a cure in any variety not decrepit from age, if the canker has not spread to the roots.

Having completely headed down, if the canker is generally prevalent, or duly thinned the branches, entirely removed every small one that is in the least degree diseased, and cut away the decayed parts of the larger, so as not to leave a single speck of the decayed wood, I cover over the surface of each wound with a mixture, whilst in a melted state, of equal parts tar and rosin, applying it with a brush immediately after the amputations have been performed, taking care to select a dry day. I prefer this to any composition with a basis of cow-dung and clay, because the latter always is more or less absorbent of moisture, and is liable to injury by rain and frost, causing alternations of moisture and dryness to the wounds, that promote decay rather than their healing, by the formation of new wood and bark. The resinous plaster seldom or never requires renewal. Mr Forsyth, the arch-advocate of earthy and alkaline plasters, finding they promoted decay if applied to the wounds of autumn-pruned trees, recommends this important act of cultivation to be postponed to the spring. Such a procrastination is always liable to defer the pruning until bleeding is the consequence. If a resinous plaster is employed, it excludes the wet, and obviates the objection to autumnal pruning. Mr Forsyth's treatment of the trunks and branches of trees, namely, scraping from them all the scaly, dry exuviæ of the bark, is to be adopted in every instance. He recommends them then to be brushed over with a thin liquid compound of fresh cow-dung, soap-suds, and urine; but I very much prefer a brine of common salt. Each acts as a gentle stimulus, which is their chief cause of benefit; and the latter is more efficacious in destroying insects, and does not, like the other, obstruct the perspiratory vessels of the tree. The brine is advantageously rubbed in with a scrubbing, or large painter's brush. Some persons recommend a liquid wash, containing, as prominent ingredients, quick-lime and wood-ashes, which, as the disease arises from an over-alkalescent state of the sap, cannot

but prove injurious, and aggravate the disease. Mr Forsyth, formerly gardener at Kensington Palace, made a considerable sensation at the close of the last, and at the commencement of the present century, by the wonderful effects produced upon trees, as he asserted, by the following composition, used as a plaster over the wounds from which the decayed or cankered parts had been cut out:—

One bushel of fresh cow-dung.
Half a bushel of lime rubbish; that from ceilings of rooms is preferable; or powdered chalk.
Half a bushel of wood-ashes.
One-sixteenth of a bushel of sand; the three last to be sifted fine. The whole to be mixed and beaten together until they form a fine plaster. (Forsyth's Observations on Fruit-Trees, p. 68.)

Mr Knight, in a very able and sarcastic pamphlet published in 1802, entitled "Some Doubts relative to the efficacy of Mr Forsyth's Plaster," fully exposed the quackery, perhaps falsehood is not too harsh a term, in this horticulturist's statements.

Mr Forsyth received a parliamentary grant of money for his discovery; but this, as Mr Knight observes, "affords a much better proof that he was paid for an important discovery, than that he made one."

"Should the public," continues this distinguished physiologist, "believe that an old dying tree can be restored to youth and vigour, merely by being plastered with lime, cow-dung, and wood-ashes, and that a piece of such tree may by such means be made immortal, I think it would be a good speculation for some enterprising genius, in imitation of the quack doctors of the sixteenth century, to bring forward a nostrum to restore and perpetuate youth in the human subject. Should such a projector join Mr Forsyth, and the one undertake the animal, and the other the vegetable world, under Dr Anderson's patronage, I will venture to predict that the success of each, in the cures they perform, will be equal."

It has been very ingeniously suggested, that, if a destruction of the bark by external violence, and consequently, likely to terminate in canker, has occurred, it would be a good plan to in-

sert, as in budding, a piece of living bark, exactly corresponding to the excision, from a less valuable tree.

In conclusion, I would enforce upon the orchardist's attention the importance of obtaining his grafts or buds from trees not affected by the disease, because, apparently, it is hereditary; and, though after-culture may eradicate the malady, it is always far better to avoid the infection than to have to employ a specific.

ON THE PROPAGATION OF FRUIT-TREES.

THE article at page 325 of the last Number by F. on the *Apple-tree*, was exceedingly interesting; it tallied precisely with our own experience, for we also had met with a notice which appeared in some periodicals seven or eight years ago. Then the public were told the same tale which recently has been revived as a novelty, that cuttings would supersede grafting, and that if those of the apple and pear particularly were inserted into potatoes, they would assuredly strike root, and produce fruitful handsome trees in a very short time.

F., it appears, brought the assertion to the proof, and, by a series of fairly conducted experiments, detected its fallacy. We did not follow in exactly the same path; but being desirous to turn the theory to advantage generally, made trial with several species of shrubs, which were of difficult propagation, and inserted cuttings into potatoes, and slices of tubers containing their eyes in some instances, and in others after having mutilated them by boring with an awl till the germ of the future shoot was obliterated; yet in every instance the cutting failed, though the potato frequently grew.

In order to bring the inquiry to issue, a notice of the renewed theory was sent to the Gardener's Gazette, and this brought a reply or rather a still more unqualified assertion of the feasibility of the practice by a correspondent, which was expressed in the paragraph that is now quoted verbatim, and signed "Samuel H. Carlisle, Vine Cottage, Romford"—"I have only to add," he says, "that, in process of time, *grafting may be dispensed with,*

not only by a scion or cutting planted in a potato or turnip, which *is sure to take* when skilfully managed, but also by a mere slip, planted as you would plant the slip of a gooseberry. Should any of your readers be disposed to doubt the practicability of this statement, I have only to say that they may call upon me, and I will lead them to ocular demonstration of the fact."

Now, here we find a positive assertion, and a challenge to the proof. Yet there needs no extraordinary perspicuity to discover somewhat of the ambiguous, or jesuitical, in the statement; for, not to be hypercritical on the style—of what fact will ocular demonstration be afforded? Will it be shewn that mere cuttings, without the medium of a tuber or bulb, have been converted into trees; or that the potato and turnip have promoted the production of roots? It might also be asked, "how do you propose to satisfy us that the tree *now rooted* and GROWING was *bona fide* in the first instance kept alive by the fluids of the tuber, &c. till the vital principle became sufficiently powerful to develop roots?" At all events we must be content to believe, and take the proof upon trust. In the mean time Mr Carlisle is bound to present a detailed account of his process, and to say, *in what consists the skilful management* of the cutting and its adjunct.

The note of the Editor, page 326, which states that "all the burr-knot and codlin tribes of apple-trees grow freely from cuttings," claims attention, and appears to be grounded on good authority. It has induced us to lay before the practical reader the following statement of a simple fact. In the year 1822, while residing near Frome in Somersetshire, we heard it asserted that a clergyman, curious in horticultural experiments, had proved that large apple-boughs, as thick as a man's arm, would take root if a foot or more of the stem were securely fixed in the soil. No mention was made of species or variety; but on applying to a nurseryman in the vicinity, it appeared that the fact was, to a limited extent, worthy of belief; and in walking about the garden two branches were selected, one about six feet long, the other about half that length; they both were, more or less, furnished with burrs, or nodose processes which afforded evident proofs of embryos of roots, somewhat resembling those aërial vascular radicles which emerge from the axils of some vines, when forced in a very moist atmosphere. The two boughs were plant-

ed late in the autumn, as deep as the shaly nature of the soil would permit, and secured firmly to stakes. There they remained during a winter, in the course of which the ground was covered for several weeks with snow.

In the April following a change of residence took place, and being desirous to perfect the experiment, the boughs were dug up, and removed to a garden-bed, the soil of which was quite artificial, being composed of little else than decayed saw-dust, and calcareous road-sand. At this distance of time it is not possible to recollect the exact condition of the stems in that part of each which had been originally placed under the surface; nevertheless, perfect roots were soon formed, and two healthy young trees were established before midsummer 1823. Fruitful spurs were developed successively, and fine fruit was yielded ere the lapse of three seasons. After seven years' probation, we left the trees standing in the same bed; and there they probably remain. The fruit of the smaller tree was delicious—of a medium size, of a russetty yellow, tinted on the sunny side with a rich deep red; it bore the local name of *Redstart*; the other tree produced excellent keeping apples, of a green russetty colour; the name could not be determined: both were probably local seedlings of Somersetshire origin, but evidently of the burr-knot family.

These facts may be relied on; and they prove that large branches, or even limbs of certain pomiferous trees, may be converted into fruitful standards without any loss of time.

As this season is propitious to a trial of cuttings inserted into tubers or bulbs, we recommend our readers to bring the process now made public, for the second time to the test of experience.

ON THE MANAGEMENT AND APPLICATION OF FARM-YARD MANURE, WITH THE VIEW OF CHECKING THE PRODUCTION OF WEEDS UPON A FARM.

By Mr George Kirk, Preston Mains, East Lothian.

The sums expended by the farmer in freeing his land of superfluous vegetation, must ever, where any thing in the shape of perfect husbandry is aimed at, form a considerable part of his whole expenditure. Large sums are annually laid out in this

way, which, for the welfare of the farmer, and prosperity of agriculture, it were desirable to see somewhat diminished, and a remedy, I conceive, may be found in a more extended study of the nature of vegetables. Climate, we know, excites a powerful influence over vegetation, and accordingly we find that every zone of the universe possesses a vegetation peculiar to itself. A plant indigenous to one zone will not flourish unprotected in another, but droops and dies, unless carefully fostered by man. Nature thence, it would appear, has endowed vegetables with a constitution, in respect to climate, which may be modified, but never radically changed. But climate is not the only thing which affects vegetation. It is also powerfully influenced by soil and situation. The appearance which climate gives to the vegetation of the globe, soil and situation in a modified form impart to that of a farm, different parts of the same farm, if composed of different descriptions of soil, being frequently occupied by a different vegetation. Certain plants we know to be as nice in their selection of a soil as they are of a climate, and as assuredly as the vegetation of the tropics will not bear the less genial clime of the temperate regions, the plants which are indigenous to a retentive clay will not flourish or prove formidable on a light soil, nor will aquatic plants present themselves in soils distinguished by their aridity. This is a theory to which I conceive it possible to give a practical direction, with the view of checking the production of weeds, and I shall proceed to shew, in a few words, how this might be brought about.

It seldom happens that farms, that is to say those of the larger class, consists solely of one description of soil. On the contrary, it is very frequently found, that a farm containing from three to four hundred acres, contains a portion of all those soils most frequently met with, that is, clay and gravel, and a soil intermediate between these two called loam. A considerable disparity always presents itself in the vegetation of these different soils. The plants indigenous to each it is needless here to particularize, as these differ considerably in different districts, and it is assumed, that every farmer must possess a knowledge of the plants peculiar to each in his own particular locality, it being sufficient for my present purpose to know, that each is bound to its native situation by what may be called a tie of nature—a

tie which can never be unbound, and which will become extinct only with the universal vegetable world.

My plan, then, of making this law in the vegetable economy subservient to the purpose of discouraging the production of the pristine tenants of the soil is, to make all the straw grown on one kind of soil into manure by itself, and where several hemmels are employed in the feeding of cattle, this might be accomplished with very little additional trouble to the farmer; and after being sufficiently prepared for being applied to the soil, I would apply that made from the straw grown on the light soil to the soils of the strongest staple, and *vice versa*. By this mode of management, the seeds of weeds contained in the manure (and it is principally through this medium that these are disseminated over a farm) would be placed in circumstances in which, from the operation of those laws, which nature has indissolubly inwoven with their frame, they could never attain to a formidable luxuriancy.

I am not sanguine enough to anticipate, that even were my theory reduced to practice, that all the weeds of a farm would thus be destroyed by natural causes, being well aware, that many plants will flourish and prove formidable on all soils; but certainly something might be done in this way which might have the effect of somewhat lessening the quantity of spontaneous vegetation, particularly that of an annual description, and in this belief I submit my suggestion to the agricultural world.

BRITISH BIRDS.

A History of British Birds, Indigenous and Migratory. By William Macgillivray, A. M., F.R.S.E., vol. i. London: Scott, Geary, and Webster. 1837.

It is one of the disadvantages attending the extensive diffusion in our age of a taste for literary and scientific knowledge, with a consequently multiplied demand for information, that when a work of real merit is produced, it is almost overlooked amid a host of inferior productions; and it is not till after its more ephemeral contemporaries have been read, and their relative merits

ascertained, that it is selected from the mass, among which it appeared, stamped with the seal of approbation, and ranked among the number of the works of genius.

The present age, indeed, is becoming one of pre-eminently superficial knowledge. Every body reads, and no subject can come amiss; an acquaintance is sought with every department of science; and while those who know best, will most readily admit, that it is the labour of a lifetime to become perfectly acquainted with a single portion of the vast range; it is hardly to be wondered at when we find that those who turn their attention to every quarter, should be able to take but a very hasty and superficial view. The desire for information is spreading more and more, and subjects which formerly occupied the attention of the learned only are now the amusement or instruction of the great body of the people. An endless variety attracts the attention of the inquirer:—the repositories of art,—the arcana of science, and the wonders of nature,—the vast stores which antiquity has bequeathed to us,—the prodigious mass which modern activity has collected, are all unlocked and set before him. Unchecked by the fear of want, he luxuriates in profusion, and tastes but the sweets on the surface; leaving behind him whatever is more difficult to be attained, or, though more solid, appears repulsive.

The taste of the readers naturally influences the style of the writers. The demand for *popular* information has given rise to an ample supply. With many, indeed, leisure, taste, or acquirements are wanting for the pursuit of more solid or scientific knowledge, and they are satisfied with the more superficial productions. And sometimes the learned will strive to familiarize the language of science and bring down philosophy to the grasp of the unlearned; sometimes, also, do shallow pretenders, who know scarcely the rudiments of their subject, set themselves up to instruct others, and produce their treatises accordingly.

From these various sources flow the ever increasing inundations of catechisms, introductions, elements, compilations, and systems, from the twopenny little book to the voluminous collection, till the student is bewildered among a multitude of guides, and finds with difficulty the information he is in search of. Amid this numerous array, is sent forth occasionally a work

f genius, reducing to order the scattered and confused fragments, systematizing the principles of the science, extending its boundaries, or filling up its details, and affording a guide to the researches of more humble enquirers:

Velut inter ignes luna minores.

In no department of knowledge has the system of which we have been speaking been so prevalent as in Natural History. The press actually teems with publications, and the shelves of the booksellers groan under the load of works on this subject, a pleasing though indirect testimony of the wide diffusion of a taste for such inquiries among all classes of the people.

The study of Nature is ever delightful and ever interesting. It has charms for every rank and for every age.

"Here innocence may wander, safe from wrongs,
And contemplation soar on seraph wings."

No wonder, then, that information on the subject should be sought for by these lovers of natural science: with the attractions of a beautiful exterior and a profusion of pretty plates, no wonder that the demand for such books is great; yet how often are they fit only to ornament a drawing-room, and how seldom do we find in them that accurate information which the student of nature seeks to obtain—those fresh and vivid paintings which none but the diligent observer of nature can furnish.

Laborious, though useful, were the critic's task to guide the inquirer in his research to examine the productions of the amateur, the scholar, or the master, as they issue from the press, and ascertain their relative merits, consigning the frivolous and the useless to deserved oblivion, awarding to the works of merit the due meed of praise, and touching those of a higher order with the wand of immortality.

It is with much satisfaction that we select, from the many volumes on Natural History which have of late issued from the press, the work before us, the first of a series on the Birds of Great Britain, as one of no common order; for it unites the accuracy of scientific arrangement and anatomical illustration with a freshness and felicity of description, that mark the keen enthusiastic observer. But we do not intend to write a panegyric, and would rather that the reader formed his opinion from the

work itself, than from our description of it. It will bear a scrutiny, and will amply repay the attention bestowed.

The author seems to have pursued his favourite study with all the enthusiasm of a votary. Devoted to it from his youth, as he tells us, he seems to have contracted a fraternal fondness for the feathered tribe. Occupiers of the same wild region, he seems to have loved to roam among them from glen to mountain range, now betaking himself to the woods, now traversing the hills and the valleys, following his favourite "from brake to bush," till he knows the step, and the flight, and the familiar cry, of every one of them, can tell of their loves and their battles, their haunts, their habits, and domestic economy, with a precision which marks a favourite and a friend. Had they been inclined to suspicion, they might have complained of his intrusion in language once employed on a very different occasion :—"Immo vero etiam in senatum venit, fit publici consilii particeps, notat et designat oculis unumquemque nostrum."

The author's fondness for ornithology seems to have been imbibed in his earliest years; but the interest excited by the lectures in the natural history class, while attending college, appears to have given his inclinations a more decided bias. Let him speak for himself, however, in his own style of modest consciousness.

"Although my qualifications for the task which I have thus undertaken will be best judged of by the manner in which it has been executed, yet I may be permitted to intimate that I have not spared time or labour to enable me to perform it with credit to myself and advantage to the public. About twenty years have elapsed since I commenced the study of ornithology; and, though a very large portion of that time has been devoted to other pursuits, I have always eagerly availed myself of the opportunities which occurred of accumulating facts relating to it. For the purpose of making myself acquainted with the natural productions of the country, I have undertaken many long journeys, performed numerous short excursions, traversed the cultivated districts, wandered among the wild moors of the interior, and visited the distant islands to which the sea-birds resort. I have endeavoured further to qualify myself for the task by attending to the observations and inferences of other students of nature, as recorded in their works, and by inspecting the objects contained in museums of natural history. My education having had reference to the medical profession, I have been enabled to profit by the taste for anatomical pursuits which I had imbibed in the course of it. The importance of the digestive organs, in particular, has seemed to me so great, that I have, as already mentioned, been induced to pay particular attention to them. Not content with accumulating notes and drawings as I had opportunity, I

have finally formed an extensive collection of preserved skins, not of British birds only, but of species from all countries; that, while preparing my observations for the press, I might be enabled to compare my descriptions, so far as they have reference to the external parts, with the originals themselves, and thus correct errors and supply deficiencies. Anatomical preparations I have also procured for the same purpose. In short, according to my ability, I have done all that seemed necessary for the occasion; and may, without presumption, hope that I shall not be considered as having rashly ventured upon an undertaking for which I am not qualified."

It is interesting to notice what fatigue enthusiasm will despise, and what difficulties it will surmount, in pursuit of the objects of its zeal. The closet naturalist, snugly entrenched in his study, muffled up in his morning gown, and attentive to the comforts of a good warm fire (while he thinks to describe the form, structure, and habits of a bird, by looking at its skin), feels none of that invigorating influence which glows in the breast of the keen lover of Nature, and has no idea of the pleasures which attend his inquiries. The observations at pp. 295, 296, and 297, might suffice as a pretty good specimen of the author's fondness for personal observation and inquiry, but we shall rather present an extract from p. 198, *et seq.*, which will serve at the same time as a specimen of his style and peculiar felicity of description. The scene is no longer in the Lothians. The wintry winds are hushed. Let us betake ourselves to wilder regions, explore the haunts, and note the habits of the grey ptarmigan. "To observe the manners of this interesting bird," says he, "let the student betake himself to Castleton in Braemar, whence he is ready to start early on a fine autumnal day;—or if he is unwilling to ascend one of those distant masses of rock, let him accompany me in idea, which is by far the most comfortable mode of travelling. * * * * These beautiful birds, while feeding, run and walk among the weather-beaten and lichen-crusted fragments of rocks, from which it is very difficult to distinguish them when they remain motionless, as they invariably do should a person be in sight. Indeed, unless you are directed to a particular spot by their strange low croaking cry, which has been compared to the harsh scream of the missel-thrush, but which seems to me much more like the cry of a frog, you may pass through a flock of ptarmigans without observing a single individual, although some of them may not be ten yards distant. When squatted, however, they utter no sound, their object being to conceal themselves; and if you discover the one from which the cry has proceeded, you generally find him on the top of a stone, ready to spring off the moment you shew an indication of hostility. If you throw a stone at him, he rises, utters his call, and is immediately joined by all the individuals around, which, to your surprise, if it be your first rencontre, you see spring up one by one from the

bare ground. They generally fly off in a loose body, with a direct and moderately rapid flight, resembling, but lighter than, that of the brown ptarmigan, and settle on a distant part of the mountain, or betake themselves to one of the neighbouring summits, perhaps more than a mile distant.

"On reaching the top of the hill, near which I observed a solitary specimen, still in flower, of Statice Armeria, I found it to be a long, broad, rounded ridge, covered with stones, gradually sloping to the west, but on the eastern side suddenly terminated by a magnificent precipice, several hundred feet high, and at least half a mile in length. The scene that now presented itself to my view was the most splendid that I had then seen. All around rose mountains beyond mountains, whose granitic ridges, rugged and tempest-beaten, furrowed by deep ravines worn by the torrents, gradually became dimmer as they receded, until at length on the verge of the horizon they were blended with the clouds, or stood abrupt against the clear sky. A solemn stillness pervaded all nature; no living creature was to be seen; the dusky wreaths of vapour rolled majestically over the dark valleys, and clung to the craggy summits of the everlasting hills. A melancholy, pleasing, incomprehensible feeling creeps over the soul when the lone wanderer contemplates the vast, the solemn, the solitary scene, over which savage grandeur and sterility preside. How glorious to live in those vast solitudes, a hunter of the red deer and the forest boar, in the times of old, when the pine woods covered all those long and winding valleys, now strewn with decayed trunks, or bare as the hill-tops around.

"The summits of the loftier mountains; Cairngorm on the one hand, Benna-muic-dui, and Benvrotan, on the other, and Loch-na-gar, in the south, were covered with mist; but the clouds had rolled westward from Ben-na-buird, on which I stood, leaving its summit entirely free. The beams of the setting sun burst in masses of light here and there through the openings between the clouds, which exhibited a hundred varying shades. There, over the ridges of yon brown and torrent-worn mountain, hangs a vast mass of livid vapour, gorgeously glowing with deep crimson along all its lower fringed margins. Here, the white shroud that clings to the peaked summits, assumes on its western side a delicate hue like that of the petals of the pale-red rose. Far away to the north, glooms a murky cloud, in which the spirits of the storm are mustering their strength, and preparing the forked lightnings, which at midnight they will fling over the valley of the Spey.

"From a small lake, in a rocky corry, at the distance of five or six miles, a white streamlet rushes down an alpine valley bounded by precipitous rocks. To the west and north-west, the mountains recede, range beyond range, apparently undiminished in grandeur, but toward the east, their ridges rapidly fall. The summits of those around are flat or rounded, composed of crumbling stones, with cairns of granitic rock protruding here and there. They are furrowed in many places by persons who, some years ago, gained a subsistence by gathering the rock-crystals and other minerals which are occasionally found among the disintegrated fragments. Many of them present vast precipices, and corries, or great cavities surrounded by rocks, in which is sometimes found a blue lake of unfathomed depth.

"Descending from the highest part of the summit, I proceeded eastward

for about half a mile, until I came to a corry facing the south, down a rapid slope, about the centre of which I descended with all possible speed, the sun having by this time sunk behind Benvrotan. Having got to the bottom of the slope, I began to run, and coming unexpectedly upon a flock of brown ptarmigans that had settled in their night's quarters, started them, to my own momentary alarm. A little farther down I saw two does, and as I approached the stream already mentioned, was somewhat alarmed by a succession of short brays or grunts, which increased in loudness and frequency, so as at length to become really frightful. It was now quite dark, so that I could see nothing distinctly at the distance of twenty yards; and whether the sounds proceeded from a rambling stag, or a water kelpie, I have never been able to learn. Crossing the stream, and ascending a low ridge, I fell in with a kind of footpath, which I followed, until I arrived over a deep glen, which I recognised. About a mile farther, finding that I was too high, I with difficulty descended the side of the glen about a quarter of a mile, until I came upon another footpath much more distinct than the upper, which led me to the place where I had seen the mountain-ash, poplar, and birch, by the stream. At length, after walking two hours in darkness, I gained the valley of the Dee, when the moon began to throw an obscure light over the shoulder of a hill, and I forded the river without accident, and reached the inn at half-past nine. Now, although after all my labour, I had only obtained half a dozen plants that were new to me, and observed the flight of a flock of ptarmigans, I conceived myself amply recompensed.

"Two nights after this, having ascended Glen Dee in the afternoon, I found myself at sunset in a valley bounded by very lofty and rugged mountains, and terminating on the side of a vast mass towering above the rest. Before I reached the head of this magnificent but desolate valley, night fell, and I was left to grope my way in the dark, among blocks of granite, by the side of one of the sources of the Dee, ten miles at least from human habitation, and with no better cheer in my wallet than a quarter of a cake of barley and a few crumbs of cheese, which a shepherd had given me. Before I resolved to halt for the night, I had unfortunately proceeded so far up the glen that I had left behind me the region of heath, so that I could not procure enough for a bed. Pulling some grass and moss, however, I spread it in a sheltered place, and, after some time, succeeded in falling into a sort of slumber. About midnight I looked up on the moon and stars that were at times covered by the masses of vapour that rolled along the summits of the mountains, which, with their tremendous precipices, completely surrounded the hollow in which I cowered, like a ptarmigan in the hill-corry. Behind me, in the west, and at the head of the glen, was a lofty mass enveloped in clouds; on the right a pyramidal rock, and beside it a peak of less elevation; on the left a ridge from the great mountain, terminating below in a dark conical prominence; and straight before me, in the east, at the distance apparently of a mile, another vast mass. Finding myself cold, although the weather was mild, I got up and made me a couch of large stones, grass, and a little short heath, unloosed my pack, covered one of my extremities with a nightcap, and thrust a pair of dry stockings on the other, ate a portion of my scanty store, drank two or three glasses of water from a neighbouring rill, placed myself

in an easy posture, and fell asleep. About sunrise I awoke, fresh, but feeble, ascended the glen, passed through a magnificent corry, composed of vast rocks of granite, ascended the steep with great difficulty, and at length gained the summit of the mountain, which was covered with light grey mist that rolled rapidly along the ridges. As the clouds cleared away at intervals, and the sun shone upon the scene, I obtained a view of the glen in which I had passed the night, the corry, the opposite hills, and a blue lake before me. The stream which I had followed I traced to two large fountains, from each of which I took a glassful, which I quaffed to the health of my best friends. Near these wells I met with a covey of grey ptarmigans, and a titling. These species are undoubtedly those which occupy the highest station in Britain as their ordinary residence; but although the latter, Anthus pratensis, is occasionally found on the very summits of Ben-na-muic-dui and Ben Nevis, it is more frequently met with on the sea-shore, and in all the intermediate country, but especially the hilly pastures. Silene acaulis was still in flower, and the whole summit was covered with Salix herbacea, both of which are eaten by the ptarmigan.

" Descending from this summit, I wandered over a high moor, came upon the brink of rocks that bounded a deep valley, in which was a black lake, proceeded over the unknown region of alternate bogs and crags, raised several flocks of grey ptarmigans, and at length, by following a ravine, entered one of the valleys of the Spey, near the mouth of which I saw a water-ouzel. It was not until noon that I reached a hut, in which I procured some milk. In the evening, at Kingussie, I examined the ample store of plants that I had collected in crossing the Grampians, and refreshed myself with a long sleep in a more comfortable bed than one of granite-slabs with a little grass and heather spread over them.

" It is delightful to wander far away from the haunts, and even the solitary huts of men, and ascending the steep mountain, seat one's self on the ruinous cairn that crowns its summit, where, amid the grey stones, the ptarmigan gleans its alpine food. There, communing with his own heart, in the wilderness, the lover of nature cannot fail to look up to nature's God. I believe it in fact impossible, in such a situation, on the height of Ben-na-muic-dui, or Ben Nevis, for example, not to be sensible, not merely of the existence, but also of the presence of a Divinity. In that sacred temple, of which the everlasting hills are the pillars, and the blue vault of heaven the dome, he must be a fiend indeed who could harbour an unholy thought. But, to know himself, one must go there alone. Accompanied by his fellows, he may see all of external nature that he could see in solitude, but the hidden things of his own heart will not be brought to light. To me the ascent of a lofty mountain has always induced a frame of mind similar to that inspired by entering a temple; and I cannot but look upon it as a gross profanation to enact in the midst of the sublimities of creation a convivial scene, such as is usually got up by parties from our large towns, who seem to have no higher aim in climbing to the top of Benlomond or Benledi than to feast there upon cold chicken and " mountain dew," and toss as many stones as they can find over the precipices.

" I have scarcely ever visited the summit of any of those mountains with-

out meeting with a covey or a pack of grey ptarmigans. These birds gather into large flocks at an earlier period than the brown species; even by the end of July. From the beginning of spring to the close of autumn, they reside on the summits or rocky slopes of the hills, seldom or never entering the region of heath; but in winter, during snow-storms, they shift their residence, and betake themselves for a while to a somewhat lower station. Their food consists of various plants, chiefly of a shrubby nature. Thus, in the crops of the individuals first described above, was contained a large quantity of fresh green twigs of Calluna vulgaris, Vaccinium Myrtillus, and Empetrum nigrum, the largest fragments not exceeding five-twelfths of an inch in length. Leaves and twigs of Vaccinium Vitis-idæa, Salix herbacea, seeds of various Junceæ and Cyperaceæ, and other plants, with berries in autumn, also form part of their food; which is thus, in fact, for the most part the same as that of the brown ptarmigan.

"It is a remarkable fact that all the grouse and ptarmigans which I have examined invariably select small fragments of white or hyaline quartz to aid the trituration of their food in the gizzard. Indeed, most of the phytiphagous birds do the same, although I have also found in the gizzards of many of them fragments of felspar, and in those of some even bits of coal and other substances. The process of digestion and assimilation is performed in the grey ptarmigan in the same manner as in the brown species and the black grouse; but as persons who enter into anatomical details have been accused of neglecting physiological explanations, I may be permitted to state the progressive changes which the food undergoes."

The following presents the contrast of a concise, as the former extract of a diffuse style, each well adapted to the subject treated of. He is describing to a companion the different modes of flight. "Before us are some birds in the hedge, chaffinches, which, as you observe, fly in a manner somewhat different from that of the sparrows. Then, the rooks, which you see high in the air, moving steadily and sedately along, with regularly-timed beats of their expanded wings, and now, as if seized with some sudden panic, or impelled by some frolicsome propensity, dashing down headlong, crossing each other, whirling and undulating: how different is their flight from that of those wood-pigeons, which advance with rapidity, moving their wings with quick strokes, and making the air whistle as they glide along; while the two white gulls, with their outstretched, long, arched wings, float buoyantly in the clear sky, bending gently to either side, as they advance from the sea.

"There certainly is a striking difference. I never thought of comparing the flights of birds.

"In time you will be able to distinguish, by their modes of flying, small birds so distant that you cannot perceive even the general tints of their plumage. Birds might be classed by their flight, and an arrangement having that faculty for its basis, would, I believe, prove as useful as one founded on the form of the feet, or of any other organ. But there goes a wren. See what a right forward, short, whirring flight the little thing has; how it flits along the fence, perches on a stump, jerks up its tail, chirps its small sharp

notes, nods and becks, and is off. There, too, a hedge-sparrow, which some call shufflewing, from a habit of slightly raising and shaking its wings; it hops away very quietly but nimbly, gets among the roots, shifts along, and flies in under the brambles, where it conceives itself secure."

Perhaps we have said enough on the subject of the author's style. Truth, however, requires us to say, that we have occasionally observed something like ridicule, or at any rate of slighting, when noticing the remarks of the "skin and closet naturalists," which, though perhaps not undeserved, tends to irritate, and might as well have been avoided.

It is difficult to observe at all times the exact medium between a too contracted and a too diffuse style, or to suit the various diversities of taste; but we think that a few of the narratives of excursions in the present volume might have been somewhat abridged, without injury to its value as an ornithological work, though in this opinion we can hardly expect the concurrence of our country readers, nor perhaps of the student of ornithology himself.

But it is time that we proceed to give an outline of the work itself. It professes to be an original production, the first of a regular systematic series. On the basis of a scientific arrangement, and of full anatomical and physiological details, the author's object is "to lay before the public descriptions of the Birds of Great Britain, more extended, and, if possible, more correct, than any previously offered; which, while calculated to interest the lover of nature, and serve as his guide and instructor in his favourite study, may tend, at the same time, "to establish a more rational method of inquiry," and to "advance the progress of science."

From such a plan, we are led to expect something of a higher order than is presented in some of the ornithological productions of the present day. It would not be very difficult to get up a neat-looking book, adorned with plates of figures, gaudily coloured, to prevent an over-nice inspection of their accuracy, containing a short description, taken from any work at hand, with numerous anecdotes, that will do for any half dozen birds, of somewhat similar size, colour, and habits; but after a perusal, the reader knows about as much of the structure and real habits of the bird as before, and perhaps would be at a loss to recognise it, did he not find above the plate "It is the lark, the

herald of the morn." Perchance, even still, he might rather think with Juliet, "It is the nightingale and not the lark."

Let us see, then, how far the work before us deserves a higher title. The following is a brief outline of it, which we shall preface by the author's opinion of what the *description* of a bird implies.

"To acquire a satisfactory knowledge of any bird, one must, in the first place, obtain a general knowledge of its external appearance, so as not only to be able to distinguish it at sight, but also to know in what respects it resembles others, or differs from them. Then he ought to examine its interior, and more especially its digestive organs, which indicate the nature of its food, the latter necessarily determining its haunts. He now seeks it there and observes its mode of walking and flying, its favourite places of resort, and its various actions, listens to its notes, follows it to its nest, which he inspects, and takes note of its migrations or local shiftings. The food can be detected with accuracy only by opening the crop and gizzard; and the changes in the colour of the plumage can be ascertained only by procuring individuals at different seasons. In attending to these and other particulars, one necessarily requires much enthusiasm, and consumes much time. Indeed the task of writing the history of a bird not of common occurrence, such as the golden eagle, the raven, or the rock-pigeon, is by no means so easy as might be imagined, unless to those who merely compose it from the accounts given by original observers, whom they frequently greatly excel in popular estimation, although in very many instances they cannot so much as have seen the objects of which they so confidently write. When the student has rendered himself familiar with a few species, his pursuits daily become more interesting; and if he at the same time compare his notes with the descriptions given by authors, he will find additional pleasure in observing the particulars in which there is a mutual agreement, and perhaps in occasionally detecting errors in his own or their statements. But at what precise period he becomes an ornithologist, I cannot venture to affirm: whether the first day on which he brings home a sparrow or a chaffinch, or after he has studied an hundred birds, and read the works of half as many authors."

In the first or introductory part, after giving an outline of the classifications of Linnæus and Vieillot, the author proceeds to point out the method of arrangement, to be followed in the succeeding descriptions.* His plan is to group the *species* according to their obvious relations, and in addition to the bill, from which the characters have generally been taken, it is a peculiarity of his plan that he adopts the *intestinal canal* as a

* In the present volume are described the orders of

1. Gallinaceous Birds. Pheasant, grouse, ptarmigan, partridge, quail, &c.
2. Cooers or Pigeons. Ringed dove, rock dove, turtle dove, &c.
3. Huskers or Conirostral Birds. Sparrows, finches, linnets, buntings, &c.
4. Crows and allied Genera. Ravens, crows, magpies, jay, starling, &c.

central point of reference, as in its modifications throwing more light upon the affinities of the larger groups of birds than those of any other organ, and as determining their food, their haunts, and their habits. Next follows, under the modest title of "Remarks on the Structure of Birds," very full anatomical and physiological details, under the heads of "the skeleton, the muscular system, nervous system, digestive organs, the wings, feet, tail, structure, muscles," &c., the whole illustrated by numerous minutely finished plates, researches for which the author's well known skill in drawing and medical education peculiarly fit him.

The *second* part is devoted to the description of the birds under the four orders we have mentioned, and is illustrated by woodcuts of the parts from which the essential characters are taken. The order generally followed is to describe the external and internal form of the male and female, the variations, the haunts, the food, the breeding and nestling the young, and their progress towards maturity, habits, and other remarks. Our limits forbid us presenting interesting descriptions of some of the most familiar.

Under the head of "Practical Ornithology," Mr Macgillivray has taken the opportunity of conveying information which cannot with propriety be treated of in connection with the regular descriptions, such as the flights of birds, bat-hunting, birds in a snow-storm—how they find shelter and food—bird-nesting, directions for preserving eggs, and other practical information. A few lessons on these subjects, conveyed in a familiar style, serve to interest the general reader, and to relieve the uniformity of description, while at the same time they are valuable to the practical student.

OBSERVATIONS ON THE USES AND MANAGEMENT OF HEATH.*

By Mr WILLIAM HOGG, Shepherd, Peeblesshire.

No prospect has a more dismal and desolate appearance than a hill or glen shaggy with old heath; nor is its produce of more value than its view is dreary. It yields little for the support of

* This paper is a continuation of one on the same subject at p. 42. vol. vi. of this Journal.—EDITOR.

nimal life, and neither man nor beast can traverse it but with ifficulty. If exposed to the south, it is dry and rocky; it is often he receptacle of venomous reptiles, which pollute the soil, and ndanger the safety of any creature which may linger about it. Any description of stock that can be put on it, is quite disroportioned in numbers to its extent, and of the few that re destined to pasture it, there is little prospect of their ever cquiring either bone or fatness. The finest summers add lmost nothing to its greenness, and it stands neglected and disegarded, and in turn gives almost nothing to its owners. Its ushes are hoary and their branches withered; even the grouse, hich will scarcely forsake their native spot, abandon it and fly tracts of younger heath, where they find the leaves juicy and utritive. Destroy this profusion of useless heath and what is e consequence? The earth is immediately clothed in a light reen with abundance of food for sheep. Let us attend to the rogress of such an improvement.

The progress of the flame is regulated by the age and dryss of the heath; the burning is most powerful and complete hen the air is calm or the progress of the flame is opposed by a oderate gale; the devouring element then, as it were, presses wn upon the soil, and more effectually clears it of impurities. he smoke has scarcely left the field when numbers of the caron-crow hover over it in all directions to pick up half-scorched sects which cannot make their escape, or small reptiles which ey know they can manage. If the operation has been perfect d complete, the whole tract is at once laid bare and open to ht, heat, dews, mists, and all the genial influences of the suceding summer; besides, the air soon floats with the seeds of ountain grasses, which lighting on this newly opened surface, uld vegetate strongly and immediately, but that their growth partly prevented by a few incidental adverse peculiarities to rnt ground, which it is impossible to prevent. In the first ce, the roots of the old heath are uninjured by the flame, fresh beneath the surface, and still continue their functions; se spread in all directions, continuing to extract nourishment m the earth, and considerably disable it from affording that pport to other plants, whose seeds may happen to alight at dom on the naked soil. Secondly, the old heath smothers

some portions of ground so closely that they entirely lose their fertility, and become, from the long deprivation of vital air and solar heat, quite effete and lifeless. On these places even the native heath cannot return till the returns of seasons have imparted fertility. Thirdly, there generally gathers among the roots of old heath a dense covering of fog. This worthless production is nourished by damp, and it retains a considerable degree of moisture in shady situations. The fire is unable to penetrate this scurf of fog, and it resists for a while all the softening influence of the summer; and whatever seeds are sown by Nature, and alight upon it, are sure to wither and decay. But to enter more particularly into this matter, we must distinguish between lea-heath and moss-heath, both of which we suppose to have been old and burnt away. Moss-heath will revive in about eight weeks, and in two weeks more it will be eatable, and by the middle or end of November its seeds are perfected, and some of them consigned to the soil. Thus, in the course of eight months, after the destruction of the parent stem, a new crop will be considerably advanced, and part of a second forthcoming. Among young heath of this description rises a plentiful growth of deer-hair, which overtops the heath for a year or two, and is every year a valuable and healthy feed for sheep. It forms its seed a little after it appears above ground, after which sheep give over using it for that season. In the third and fourth year heath gets quite the mastery, I mean before the deer-hair gets above the heath, its fructification is completed when it stands disregarded. Another year or two more burning is again necessary, to give a fresh and renovated crop of heath, deer-hair, and several varieties of bent. After each successive burning there is abundance of meat from all those hardy plants, but previous to this operation they are very sparingly tasted of.

The return of young heath upon a dry and earthy soil is more tardy than on a soil of a contrary description, and its coming is determined by the state in which the roots of the old heath were in at time of burning: if these have been fresh and vigorous, a considerable quantity will make its appearance the second year; in the third year it will give plenty of food, and in every season for five or six years more will continue to augment in quantity; but after its third and fourth years it will lose

considerably its nutritive qualities; and if it have been very old, perhaps half a century old, and the situation dry and steep, with a southern exposure, the last burning will be its final extermination, for it is the improper management, or total neglect of this shrub, that ultimately eradicates it from a soil of any description.

The kindred grasses which rise up with a new crop of lea-heath, are some varieties of bent, and a tender plant resembling wild clover, longer in the stalk and full of juice, but it soon decays. In all situations I have observed it, it is so scarce that it can hardly be ranked as food for sheep. A little after the former varieties in coming is the fly-bent—a worthless plant—is no sooner up than is withered on the top, feels dry, rough, and jaggy to the human touch—with reluctance draws from a socket near the ground—and, with the exception of its roots, appears to be a dry insipid plant, which cattle and sheep are careless about. Indeed the juices of all the varieties of bent centres in the root.

Upon a comparison of the different properties of the two heaths, the preference must be given to moss-heath, the bents which rise with every new crop of which being more valuable, and rising sooner, are longer pastured, and both they and the heath are more susceptible of being oftener renewed by burning, which may be every sixth, seventh, or eighth year, but the period of burning will be determined by the age of other heaths upon the same farm. The periods of burning lea-heath should also be regulated by the same rule; but I believe more frequent than every ninth or tenth year is impossible, but at the conclusion of each period of this duration, a renovation should be given to this species of heath as well as to all the varieties of bent which rise along with it.

The situations in which these different heaths respectively, are usually found, not unfrequently impart an importance and value to the last variety, which moss-heath cannot have. Moss-heath spreads far and wide over glens, tops and shoulders of hills, and is directly adapted for summer food. Lea-heath grows often on low grounds, round the base of the hills, along the sides of the mountain streams, which are accessible through winter, and is always the last resource which sheep have during

a heavy storm of snow, when pasture of every other description fails them. Hence, in so far as winter food during hard and pinching times is more valuable than summer grazing, when every species of food is luxuriating in abundance, is lea-heath superior to that which springs from pure moss.

Before quitting the consideration of the peculiarities of the two soils from which heath has been burned, it is necessary to notice, that a lea soil, after this operation, sends up secondary varieties of grass, which never had existence in the neighbourhood in the recollection of any person alive. The seeds of these had no doubt been deposited in the mould perhaps centuries before, and being perfectly secure from either too much drought or too much moisture, had preserved their vitality for ages, and the soil being all at once exposed to atmospheric influences, immediately germinate and bring forth what had clothed it in former periods of time.

Let us now attend to the objections commonly brought against the probable improvement of burning heath. "It divests the ground of shelter," say our old storemasters and shepherds. In answer to this, I notice that the extermination of old heath is more common now than formerly, and the flocks have suffered nothing by the practice. Besides a more tender breed of sheep is now adopted on many of the heathy pastures, a breed needing more protection and less able to travel for it; they succeed as well—are in as full habit in spring, and nurse their lambs nearly as successfully as the old breed; and I maintain, that a judicious and regular burning of heath would increase the quantity of food nearly in a tenfold proportion on the space from which it has been exterminated; and this is one reason why Cheviots on heathy pastures have prospered beyond expectation; yet it must be conceded, that strong heath on low dry situations, and where openings of green are interspersed, is good shelter; whereas, an uninterrupted space, standing thick and deep with old withered heath, is neither safety nor food for any creature, and unless forced into it by keen distress, no creature will resort to it for protection. I may also observe, that flocks of sheep are found equally good on pastures where there is scarcely a sprig of heath for food or shelter.

"But," says the lord of the manor, "it is both food and cover for my young grouse, and I cannot allow my tenants to take their will regarding it." The moorfowl seldom or never feeds on old heath. The tender and juicy sprigs of the young germs of heath they invariably select for food; and except when driven by the blue hawk, I never saw them condescend to seek shelter in it from any creature or any weather; even in the darkest snow-drifts they often feed on this young plant on the most exposed situations; nor will they seek shelter on even the lee side of the hill until they have gathered together a few grains, when they cower down and let the snow drift them up, in which situation they continue warm, dry, and comfortable, till the hurricane subsides, and then they spring into the air with all the vigour peculiar to that hardy bird.

Strong heath, it must be acknowledged, affords protection to moorfowl during the time of hatching, yet the spot which they choose is seldom in the midst of a field, or in a large space of old heath. As far as I ever noticed, their nests were always pitched along the openings made by grass, or on the confines where old heath and new meet; and once I remember of seeing one of their nests in a piece of wet boggy ground, but it was close in the neighbourhood of heath.

"Well," says the proprietor, "if old heath can protect my game from the ravages of voracious birds, I will have it spared though it were good for no other purpose." The blue hawk is powerful and active in destroying his victims, and when he fixes upon any individual moorfowl for his prey, it seldom escapes. His method of attack is by making an accelerated push into the air, transfixing it at once with his talons, or else, previous to the deadly thrust being given, should the moorfowl drop perpendicularly to the earth, such is the strength and rapidity of the pursuit of this noble bird in pursuing, that in that case I have seen him overshoot his quarry for some thousands of paces before he could check his flight, and return to the pursuit; but his perceptions are too acute to be long eluded; he generally finds his trembling victim almost dead with terror, with his head only thrust beneath a tuft of heath, where at once he sinks his talons through his heart, rises into the air with him,

carries him to a place of safety, where he knows he can enjoy his feast unmolested. These two methods are usually the way in which that rapacious bird destroys his game, and I do not believe that one in twenty escapes, of those he fairly selects for his prey.

There is an allegation brought against heath which I believe is true ; but it proceeds from mere mismanagement, like many other gifts of Providence which we abuse, namely, that heath is so late in springing, that before it offers a succulent bite to sheep of that year's growth, the principal distress for food is over for the season. The neglected and despised state in which heath is found on many farms, incapacitates it from vegetating sooner than about the middle of June, and if it be very old scarcely a dozen of the topmost branches can be noticed to spring in a season, and even those shoots are very small ; whereas, were it kept to a proper age it will vegetate very little later than many of the mountain grasses. At Whitsunday the young germs will give a plentiful and nutritious bite, and this is far from being a late period. Indeed, there is no alpine plant that I am acquainted with, whose qualities can be as much exalted and improved as heath. Draining wet pastures triples their value, which it does by changing the qualities of the soil, and causing it to produce a new class of richer grasses ; but keeping heath only to a proper age, continues the soil unchanged, and enhances its produce in a tenfold degree.

Although I have condescended on a term of years at which heath might be renovated by burning, the safest and most general rule that can be adopted, is to burn it whenever it will burn thoroughly and completely, and except the single disadvantage of not yielding sufficient cover to moorfowl during the time of incubation, it is in the young state most beneficial for all creatures whose instincts and habits direct them to a heathy soil for food. Also at every repeated burning, the various bents which occupy the soil in conjunction with heath get a complete renovation, and though these plants are mostly annual, yet no crop of them is so fresh and succulent as that which immediately succeeds the burning of heath.

ON THE CAUSES OF BRAXY IN SHEEP.

By Mr James Carmichael, Raploch Farm, Stirlingshire.

The diseases of that invaluable animal, the sheep, though not few, are fortunately of comparatively rare occurrence, except the endemic termed braxy, so fatal to young sheep, especially hoggets; and long as this malady has been known, and severely as store-masters have periodically suffered by its ravages, often to the extent of a fourth of a large flock, yet no remedy for it has hitherto been discovered, nor have the characteristics or predisposing causes of the disorder ever been satisfactorily defined. That it is *endemic* is obvious, from the fact of its attacking sheep in certain districts, while others of the same age and breed, and perhaps on the neighbouring farm, almost entirely escape. It is not contagious, nor does it early exhibit premonitory symptoms. The whole flock seems safe and well at night, and next morning twenty, perhaps, of the best (for the fattest are noticed to fall first) are found dead, within a small compass of ground, with no external marks of violence, and all lying in such a situation as to preclude the possibility of accident, but all at the same time presenting one and the same appearance.

On examination, the body is found much swollen, and of a very deep red colour, particularly the side which is lying undermost, the whole intestines being highly inflamed, the membrane of fat enveloping the great gut extravasated with blood, and large globules of water interspersed; and on turning out the intestines, a quantity of blood and serum is found floating within the body. The liver is healthy, and the gall-duct full, the heart distended, and the interior cavities filled with coagulated blood, even while the body is still warm. The lungs are very much distended, and the windpipe full of froth, or frothy mucus, resembling soap-bubbles, which are largely suspended round the nostrils. The kidneys are much inflamed, the bladder is generally empty, the anus-duct full of very hard fæces, and the small or anterior portion of the intestines inflated with gas. The contents of the stomach, or first bag, are exceedingly dry and compressed, while that of the great gut is quite moist, as if

fermenting, with a highly offensive smell. Indeed, the whole carcass begins to smell very soon after death.

Inexplicable as these effects may seem to the careless shepherd or casual observer, they are nevertheless easily explained on natural principles. The braxy is an inflammation of the bowels of the most violent description, arising from the state of the food which the animal has taken, namely, very succulent grass loaded with hoar-frost. This is demonstrated by the circumstance of the distemper being most prevalent in the end of autumn and commencement of winter, when the hogg pastures are rankest, and the hoar-frost heaviest; it being then found that a night of hoar-frost is invariably followed on the second or third day by a number of deaths, or cases of braxy, *especially* where the pastures have a *steep northern exposure, or are shaded by brushwood, copse, or ferns*, all of which are very unfit as walks for hoggs or young sheep, though much sought after, because the hoar-frost is deposited soonest, and remains longest amid these shaded situations, where also is produced the softest but least wholesome herbage, thus inducing the sheep to resort thither for food and shelter. This circumstance solves one cause of the aversion to ferns, so often expressed by graziers, yet questioned by landlords, but which neither could explain, though both felt the effects, the former in the loss of his stock, and the latter in an abatement of rent; and it therefore presents an additional reason for the total eradication of so baneful a weed. Were it not for the temporary loss of pasture it might occasion, probably the best mode would be, where cutting has been neglected, to set fire to the ferns when ripe, which would completely destroy the stems of the plant, and also the seeds on the ground.*

Such is the positive state of the case, and no remedy is within the power of medicine, for it cannot be administered on a mountain side to a numerous flock in an instant, nor are affected sheep distinguishable from others till past recovery. The negative proofs are equally conclusive, as it will readily be admitted on all hands, that the healthiest winter ground for hoggs is an open southern aspect, where the morning sun, and milder atmosphere, immediately dispell the hoar-frost, or where a mixture

* Irrigation completely destroys ferns.—EDITOR.

of heath or coarse herbage abounds, on which the hoar-frost does not only not lie so close, and therefore cannot be eaten in such quantity as to destroy the sheep, but the astringent nature of which counteracts the liability of soft grasses to fermentation in the bowels. Were the state of the weather, then, more attended to by those whose interests are so deeply involved in this matter, and on every evening indicative of frost, or at least early next morning, were the hoggs to be removed from their *lairs* to higher open ground till the hoar-frost disappeared, the risk would be infinitely lessened. And it might be well to keep some hay in reserve for such occasions, by those who raise no turnips. But turnips are so beneficial to hoggs, besides improving the soil, and requiring less extent of pasture ground, that every store-master should attempt the raising of them; even one-half acre of good turnips to every twenty hoggs, with a few rations of hay, are excellent preventives of braxy. In many parts of England, colewort is sown for hoggs, and agrees remarkably well with them. But to a great many store-farmers, such substitutes for sheep winter food are altogether inaccessible, consequently to them sound pasture is of much more importance.

Besides the danger attached to certain localities, there is another, resulting from the treatment of the lambs after weaning. If they have been travelled far, are much fatigued, or been heated by the journey, they are more liable to be seized with braxy than those commingled with them on the same keep, who have not been so driven. And wether or castrated lambs, whose constitutional habits are affected by that operation, as also ram-lambs, whose constitutions are unconfirmed, seem to be more susceptible of the disease than ewe-lambs. Nor are old sheep entirely exempt, exhausted rams and old ewes, during hoar-frost in spring, often perishing in the same way in similar situations.

In farther illustration of the truth of these remarks, it may be added, that an instance can be given of a mountain deer, which had been in the habit of going with the milch cows on a property in the north. It was a doe, quite tame and healthy, and went out and in with the cows every day, until one evening, in the end of October 1834, she jumped in sport over the fence, and being neglected to be brought home with the cows, strayed to a clover field, where she partook freely of the rich herbage,

which was covered with that deadly poison hoar-frost. Katie, as she was named, returned and rejoined her companions, but died in the course of the following night, and on being opened, exhibited precisely the same affection of parts as in the preceding cases related of the sheep, and thus the noble deer died of loathsome braxy.

ON GREEN MANURE.

By Mr A. Gorrie, Annat Cottage.

The increasing demand for manure renders it necessary to press into service every ingredient that can add to the general stock.

Although dry substances, such as the straw of the cereal or leguminous crops, require and are improved by *moderate* fermentation before being mixed with the soil, yet I am decidedly of opinion, that all green and succulent herbage give off, in the shape of gas, their most valuable qualities during the very violent process of fermentation to which, from their nature, they are liable. I therefore consider it would be of advantage to the farmer to *plough in* as much green manure as may be within his reach in the course of the season. In the spring and early months of summer, indeed, little in this way offers itself beyond the garden; but, even then, a little saving tells, on the principle that "twa littles mak a muckle." In the garden, about the season of planting early potatoes, is also the season for clipping box-edgings; and where the box is five or six inches high, as is often the case in the garden of the farmer, an expert hand, which I would always understand the farmer himself to be, would soon mow a large heap of trimmings with the scythe in the twentieth part of the time, and to much better purpose than could be done with box-scissors. From long established prejudice, the trimmings of box have been considered pernicious to soil, and hence they are generally swept away, and removed as a nuisance; but let them have a fair trial, that is, plant row for row of potatoes with farm-yard dung and box trimmings, and the returns will be found equal in weight, with this difference in favour of box, that the tubers are more equal, fewer small,

and the quality drier than where planted with dung. My experience in this case only extends to where the soil is what is termed strong black loam. Carrots, too, prosper well where box-trimmings are dug in.

Towards the middle of June is the time for going over oat fields, and cutting or pulling up thistles, the common scabious, and such other weeds as may prove hurtful to the growing crop, and of which considerable quantities appear when oats are the last crop in the rotation, or that immediately preceding fallow. I do not justify the having many such to pull in any field, or at any time, as a symptom of good farming; but it will be allowed, that where such do exist, their removal is necessary; and where they really are, they come very opportunely for manuring a few drills of field-turnips. The black mustard, or any of the annual cruciferæ which infest corn lands, form powerful manure. Should the weeding proceed simultaneously with the preparation of the turnip ground, let the drills, in place of the ordinary width of twenty-seven inches, be opened at about thirty-two inches from crown to crown; then let a moderately thick layer of weedings be laid in them, taking care to tread them in, so as they shall be completely covered with the soil in forming the drills for the seed. It will be useful to pass a heavy roller over the ground so manured after sowing. At the same season, several pernicious weeds run to flower-stem about the barn-yard and waste grounds near the steading, such as the common dock. If this plant, in particular, is allowed to stand a month longer, its seeds are perfected; and in the end of autumn, in breaking up the barn-yard, those seeds find their way into the dung or straw-yard, and are, of course, carried out to the field, where, in a short time, they appear as standing evidence of slovenly practice, whereas if cut while in flower, and applied along with nettles and other like rubbish, as green manure to the turnip-field, they are converted into use instead of being a nuisance. A small part of a field of turnips which was dunged with green manure, as here described, was sold by auction by the square fall. That portion manured with green weeds was purchased by a neighbouring farmer who witnessed the process at 1s. 6d. per fall (36 falls being equal to one rood imperial). The rest of the field, where farm-yard partially fermented manure was used, only

brought 1s. 3d. per fall, although the drills were a half foot narrower, and consequently, more length of drill in the area. It is proper to mention, that one year when green manure was applied in drills of twenty-seven inches, the weeds were imperfectly covered, and dry weather succeeding, the experiment, as far as the turnips were concerned, was a complete failure; but the subsequent crops bear testimony to the excellence of the manure. Any green foggage that may be had in August and the early part of September, ought to be ploughed in in the last furrow for fallow wheat.

A very powerful manure, of which too little notice is taken, occurs in the stems of potatoes. This very succulent article is almost always allowed to dry and bleach on the surface of the ground, or is driven to the bottom of the cattle-yard, where the juices sink, and are lost. About the middle of October, potato stems are frequently found to contain a large quantity of vegetable juice; and at that advanced period of the season, it is time to be securing the valuable crop of potatoes. Where the stems are luxuriant, it is best to have them all *hand-pulled*, and carted off to a clover-lea field where wheat is to be sown, before the plough enters to turn over the furrows. This is a more cleanly practice than leaving the stems on the ground till gathered by the harrow; and it also prevents any root-weeds from being carted off and ploughed in, a few of which may still be found in potato fields at the time of taking up, especially in wet seasons. After the stems are thus removed, and those tubers gathered which came up with them, the plough meets with no choking in splitting out the drills of potatoes; and every root-weed, if any, is then easily seen, and should be hand-picked after the harrows. This operation over, it is time to have the clover-lea ploughed. A boy with a fork must accompany each plough to push in the stems, so as they may all be regularly and completely buried. The stems on five acres, if moderately luxuriant, will manure one acre well, and the wheat will appear *more luxuriant* than on the neighbouring ridges, where from fifteen to twenty tons of farm-yard dung may have been applied.

In the winter months there is little of which farmers can avail themselves in the way of green manure. When access can be had to the leaves of trees early in November, the farmer would

find his account in appropriating them to his use; and where near the manor, the landlord would, no doubt, thankfully get rid of them as a nuisance. They should be laid in large heaps or pits in the beginning of winter, where they should be allowed to remain *twelve months*, by which time they will be partially decomposed when they should be driven to the cattle-yard, where they form comfortable bedding, and imbibe the liquid part of the manure, which otherwise might escape, and form a wholesome manure for any soil or plant.

ON REARING DOMESTIC POULTRY.

It has frequently occurred to us, that the management of a poultry-yard is not so rationally conducted as it ought to be. When we consider the rapid advances that have been made of late years among the industrious classes of the community in intellectual acquirements, more especially in the southern parts of the kingdom,—Scotland having been for a series of years an educated country, while the same classes in England were yet in ignorance, we feel warranted in our objections, because we have practically proved the fallacy of the "auld warld" methods of treating that portion of our live-stock, and have established our right to make those objections, by the success which has attended our own plan. The best test of our ability in the office which we can offer to our readers is, that we pay Nature the compliment to suffer her to dictate to us, and that, as far as possible, we attend to her wise and simple laws. If this candid acknowledgement be in our favour, we fear not to gain proselytes from the old to the new method, and proceed to the detail.

In large farms, and among the very poor, it would not be desirable to have a poultry-yard portioned off; in the former case, because that part of the live-stock is subsidiary, in the latter, because the outlay, though trifling, would be too considerable. A very numerous class of persons, however, remain, to whom the rearing of poultry might be an object of emolument; and others again, who seek for no remuneration beyond the pleasure which arises from possessing the means of consuming those animals which are the produce of their own estates. In all cases

it is gratifying to know and to follow a plan which leads to the most satisfactory results ; and *that* is presumed to be the best, which is founded upon the experience of years. We will begin with

The Poultry-Yard.—This ought, when practicable, to be separated from the other portions of the premises devoted to live-stock, and even subdivided when various kinds of fowls are kept which are inimical to each other, as is the case with the guinea-fowls (or Pintadas, or Gallinæ, as they are indiscriminately called), and the more familiar tribe of cocks and hens. The yard should be dry, as nothing is so injurious as damp; in order to effect this the surface should be gravel, on a foundation of chalk, for the benefit of quick drainage. This preliminary we consider all but indispensable ; the difference that would be experienced in the well-doing of poultry that is reared on a gravel or chalk-paved yard from those that *draggle* through their existence on wet clayey ground or grass is astonishing. The yard should have a full exposure to the south, and contain an open shed for shelter from either sun or rain. Within it should be placed dry sand, ashes, small gravel, and chalk, for the use of the birds; the two first named materials they require for the purpose of dusting themselves, a process in which they not only delight, but which is essential for their health ; the fine gravel is constantly picked up by them, and without it, their food would not undergo a healthful state of digestion. Although the space allotted to them is to be separated from the general farm, it should be contiguous to a meadow or a common, for grass is absolutely necessary for them ; a small opening should, therefore, be made in the fence, through which they may gain access to it. Instinct will teach the old birds to remain no longer than is needful ;—of chickens we shall speak hereafter. We have had opportunities of comparing the state of poultry which had been prevented from ranging among grass with our own that had never been debarred from it, and the results were so satisfactory to us that we cannot do otherwise than recommend the plan. No animal thrives well upon one only species of food ; of man himself it is asked "Can he live by bread alone?" The craving which poultry evince for a change of food is evident to all who will take the trouble to watch them ; after having

eaten well of variety, with a profusion of the grain yet lying before them, they will eagerly run to a common and finish their meal, upon the various aliments that are presented to their choice,—grubs, worms, insects, and even of the grass itself they will eat very considerable quantities when left to their own freedom, and this not now and then only, but daily, for they live very regularly. Their habits appear to be as fixed as those of mankind; they like to be abroad early in the morning, before the slugs, &c., which are most alert during the hours of darkness, have retired to the earth; they then return to their corn, which they rarely finish until they have been abroad. After having drunk water and dusted themselves, the hens proceed to the nests for the purpose of laying. They afterwards lie lazily about, take their *siesta* towards noon, then look for their mid-day meal; again sally forth to the grass and rove about at their ease, until it is time for them to receive a third feed, when they retire to roost, in summer about six, in winter towards four o'clock.

The most approved species of Poultry.—In a former number of this periodical, all the kinds are enumerated, and their different qualities specified, so that choice may thus be made. (See No. xxxi. Dec. 1835, pp. 372–390.) We have but to observe that *white* fowls with short legs are those to which we give preference. There exists a prejudice against them, that they are more tender than those with dark plumage; we have not found this to be the case, though we are decidedly of opinion that the flesh of the former is more delicate than that of dark fowls with black legs.

Poultry-houses.—If the number of fowls to be kept be very considerable, it would, perhaps, be right to have two or three dormitories, in the event of infectious disorders appearing among the stock; but we do not offer this opinion as our own, having never experienced any illness of a contagious kind, nor having indeed lost any of our numerous stock, except from casualties and accidents. One roomy,—nay, lofty fowl-house, will be sufficient where judicious attention is paid to the following particulars. Ventilation is highly requisite, for where numerous creatures congregate and remain shut up for many hours, an unhealthy heat will be generated, and a bad effluvia from the manure will stagnate and create disorders which would never

exist if free ventilation and cleanliness were attended to. We have seen in those anomalous spots peculiar to England, yet christened by a French name, and styled "*Fermes Ornées*," where every item was pretty, and expensive, and ornamental, and artificial, and, consequently, liable to failure;—we say, in such places, we have seen fowl-houses, barely seven feet in height, with plastered walls and *ceiled* ceiling, with close-shutting door, and a glazed casement, not made to open! The inevitable consequences were most offensive odours, and a sickly stock, which of course consisted of the most expensive, because rare species, and were continually obliged to be renewed.

Fowl-houses, we repeat, should be lofty, and securely closed in the lower part, to prevent the ingress of vermin, not only foxes, but stoats, weasels, rats, &c. The upper portion may be very open, as much so indeed as is consistent with due shelter from rain As it is the nature of warm air to ascend, it is evident that the atmosphere which is heated with, and contaminated by, the creatures and their odour, will ascend and prevent the descent of cold air. The floor of the dormitory ought to be formed of any convenient material which will be found to be most dry, even, and commodious, in order to allow of its being frequently washed. In laying the floor, a gradual slope should be made towards the middle, or to one side, where a drain might carry off the moisture, after it had been scrubbed with a birch-broom. All good farmers and gardeners are aware of the value to their land of every kind of manure, and need not our recommendation to save every portion; hence, the drain from the hen-house will of course be made to communicate with the general reservoir of liquid sullage, which *every country homestead* ought to possess in the most convenient corner of the premises, where it could be covered in and kept from evaporation, by a rough building or shed erected over it. The boxes for nests should be constructed of unplaned boards, and fastened to the walls about three feet from the ground, and by no means should they be placed in the fowl-house; an out-building ought to be devoted to the purpose, where the birds may fulfil their duties either of laying or sitting quite undisturbed,—a fowl-house appears to be sedulously avoided by poultry, excepting at the hours of rest. Clean straw, not very long, must be coiled

round in the nests, but hay should never be made use of; the scent is said to be too powerful for the birds, and to harbour insects. We do not assert this of our own knowledge, but had we not heard any objections made to the use of the latter, we should give the preference to straw.

The fowl-house should be lime-whited every spring. The perches for roosting should be of different heights, but wider apart than the length of the larger sized birds, to prevent the fowls which may roost on the lower poles from being inconvenienced by those above them. A sloping board with slips of deal nailed on to it, at distances of three inches, should be fixed from the floor to the lower range of perches, to facilitate the ascent of chickens when they have left their coops, and begin to assume the dignity of roosting fowls. The door of the house should be set open every morning when the birds are let out, to preserve the place healthful by constant ventilation; and where no objection exists to its being kept open all day, there need be no other place of ingress and egress; where, however, such objection does exist, an opening must be made in the door itself at the bottom, large enough to admit the birds, which (the opening) should have a sliding board made to run in grooves, that must be closed in the evening when the fowls are locked in, and this is a precaution which no one will neglect who values his poultry. It will be seen that by closing the little door, we prevent all egress in a morning, until some one of the family may be stirring. Long experience has taught us the value of the regulation; for not only are the fowls thus preserved from the attacks of early marauders of every kind (and many persons would not hesitate to run down and appropriate a wandering pullet who would fear to rob a hen-roost !), but the young chickens are thus prevented from strolling into the grass while yet it remains saturated with rain or heavy dew; nor will the creatures be debarred from their favourite and natural morning meal by this arrangement, since, where animals are kept in an establishment, persons must be abroad sufficiently early to allow of their finding worms, &c., before the sun shall have exerted so much power upon them, as to drive them into their holes, and remove the dew from the grass.

Treatment of the Poultry.—Having cared for their accommodation, we will proceed to the birds themselves. The stock being chosen—in which we would recommend that some of the "everlasting layers" be introduced—the proprietor will commence his observations. A poultry-yard is replete with interest, but, as every one may not feel equally impressed with a sense of it, and, moreover, possess neither time nor inclination to give the subject personal attention, and thus gain experience for himself, we will do our best to impart our own. We are convinced, however, that if the "master's eye" be not upon the creatures of his farm, they will fare the worse. Servants, however faithful and trust-worthy, *cannot* accomplish all that is wished of their vigilance, nor can they feel that degree of interest which is necessary in the creatures committed to their charge. Their minds are not of the same calibre, their education has not fitted them to comprehend the philosophic motives which their employers might bring to bear upon the subject; hence, to have proper attention paid, it is absolutely requisite that a master should not only say to his servant—"Do!" but see that "he doeth."

A stock of fowls should consist of pullets and hens of from one to four years of age; they usually are supposed to decline after the third year; but when any good quality is evinced, such as being good layers, close sitters, or careful mothers, it is obvious that, to deprive ourselves of valuable dependents, only because "it is said" that they are on the wane at a certain age, is sufficiently absurd. It is a fallacy to deem those hens inferior which happen to possess large combs; it is equally a mistake to consider that those which crow like a cock are worthless; and to attempt to refute the popular superstition that it is "unlucky" to keep a crowing hen would be idle; it is too ridiculous to be further alluded to. The number of laying fowls, will, of course, depend on the wish of the individual, and his facilities for their accommodation. A large number is quite as easily attended to as a scanty stock. If only four, five, or six hens be kept, one cock will be sufficient, and it will be better to increase the stock by degrees, for a year or two, by allowing a young cock to grow, rather than to introduce another from a foreign collection. Battles and persecution would be, in the latter case, endless. A

change of breed can always be accomplished, by procuring eggs from an approved stock. Eggs that are intended for sitting, "it is said," should not exceed a month old; and as, in a state of nature, a hen would occupy nearly that period in laying the usual complement of eggs, the rule is a good one; but a simple process, which we shall hereafter describe, whereby they may be preserved fresh, eatable, and *sittable*, for many months, will render all precaution as to the length of the time they may have been laid unnecessary. Fifteen eggs will be generally sufficient for hens of the usual size, though the very finest, healthiest, and most successful breed we ever had, was the produce of a white hen which had "stolen a nest," had laid sixteen eggs, and brought forth the whole number of chickens, every one of which she reared. We would not recommend that hens be allowed to sit until after the turn of days. Early in January, if the weather be mild, they will sometimes indicate a wish to incubate, which need not be thwarted, if conveniences can be commanded for the accommodation of the mother and her brood. Constant attention, however, is requisite, and, from being reared totally under shelter, the chickens, like hot-house plants, will be so tender, that there is small chance of ultimate success. The same objection exists against attempting to rear a brood late in the autumn; the first week in September is the latest period at which it ought to be hazarded. There is yet another time, during which it is absolutely indispensable that hens be prevented from sitting, and that is the month of June. Close observation (after having suffered at that season numerous failures most unaccountably) enabled us to discover the cause, and thereby verify the truth of an old saying which we have since met with—

> "Between the sickle and the scythe,
> What you rear will seldom thrive."

We had noticed that chickens which were hatched during the month of July were almost all attacked about the time of their first moulting (a period always attended with much suffering to them) with a fatal disorder, the symptoms of which were unvarying. The chickens appeared to collapse, and moved about with difficulty, as if their joints were stiffened, or rather as if the skin had become tight and tender; their feathers became rough and stood out; their wings drooped and dragged on the

ground; they refused sustenance; and becoming more and more weak and torpid, they, in a day or two, died off in great numbers. Every rational means was resorted to, in order to arrest, or even account for, the disorder; at length it was discovered, that they were in a high state of fever, and that the extreme redness of the skin was caused by the irritation of hundreds of that minute pest the harvest bug. Some—very few—were recovered by anointing them all over with oil and vinegar;* but the recipe is too rough for little delicate creatures, already enduring the pain attendant on the season of moulting. It became obvious, that the period during which harvest bugs are most numerous and tormenting, must be inimical to the rearing of chickens; and that, if the hens were not allowed to sit in June, or rather, if the chicks were either strong enough to cope with the evil, or were not hatched until the season for the pest had passed by, that the destruction might be prevented, and so it has proved.

We do not suppose that we are addressing readers who are entirely ignorant on the subject of poultry, and therefore omit the more obvious and simple directions and information; such as the indications by which it may be known when a hen is inclined to sit; how long a time elapses before her chickens will be hatched, &c.; yet we would not that one reader should be disappointed by the incompleteness of the subject on which we are writing .It may be as well therefore to state, that when hens shall have laid from ten to twenty eggs, they generally, but not always, shew the first symptom of a desire to incubate, which is remaining a long time upon the nest; they then begin to cluck, and their combs lose that bright red colour (the infallible sign of good health, and disposition to lay) which they had shewn. Very young hens sometimes deceive by evincing all these symptoms, and will even take to an empty nest, and remain close for a day or two, yet directly after they are put in possession of all they appear to require, will capriciously leave the eggs and resume their usual habits. It is customary to place an odd number of eggs under a hen, not "for luck," as

* It should be known, that this is the best, nay, the only remedy for the annoyance which human beings experience from the same cause.

he auld wives suppose, but because they lie more round and compact. A large sized hen will cover fifteen well; but if she find the number too many, she will reject one. Should an egg be broken it must be removed, and her feathers washed from the clammy substance. For the first few days, some hens will sit so steadily, that they will not leave the nest for food. Fears have been expressed for the lives of hens under these circumstances, but we incline to think they might be left to Nature; however, no harm can accrue from lifting them off the nests and placing food and water ready for them in the open air. They are refreshed by the change, and resume their solitary duty in comfort. Food and water should always be provided for sitting hens once a-day, and that at a time when they cannot be persecuted and driven away from it by their congeners, namely, either before the fowls are let out in a morning, or after they have retired to roost. The plan of feeding them on the nest is perfectly erroneous, and contrary to nature. It is requisite, for the sake of cleanliness and health, that hens should leave it once in twenty-four hours. As an attention to cleanliness is indispensable in every department of a homestead, we need scarcely mention that clean short straw should be provided for every sitting hen, and the nests be thoroughly cleaned out when the brood is hatched.

It is much to be deplored that, in subjecting creatures to our use, we cannot make their comfort a greater object of attention. Granting that man has had control given him over the brute creation, it surely would prove his fitness for the gift that he should exercise his authority with kindness, and temper his power with mercy. If Nature must be thwarted, it should be effected in the gentlest manner. It sometimes happens, for example, that it is desirable to prevent hens from sitting, when eggs are more in request than chickens: to obtain this end, we have known very cruel methods practised, such as plunging the poor birds into water, swinging them violently round, &c. The most effectual plan, and the one least objectionable, is to confine them under coops, in a dark place, with plenty of clean water, and a rather short allowance of food, for two or three days. If on restoring them their liberty they should return to the nests, a repetition of the discipline for another day or two will gene-

rally be found an effectual preventive. By watching the denizens of a poultry-yard, not only much amusement is afforded, but no little information of a practically useful nature may be obtained. It will be seen which of the hens evince a disposition to sit, which to lay eggs, &c., and we ourselves enjoy the comfort of gratifying rather than crossing their instincts, by attending to these indications. When a hen has sat three weeks (twenty-one days), arrangements should be made for the young brood, but no interference should be allowed. Man is so conceited, that *poor bungling Nature* cannot be expected to proceed in any of her operations without his assistance! How could chickens break the shell if he were not kindly to aid them? When he or she has efficaciously taken this duty from Nature, he carries the little fragile things in his rough awkward hands, pokes them into a basket with some hay, which he sets before the kitchen fire, having first pulled off the scale at the tip of their beaks, forced open their jaws and thrust a pepper-corn down their throats. Then enter "a whole tide of children" and maid-servants, all eager to look at and fondle the "pretty dears!" and, in the struggle for precedence, down goes the basket with its half-dead inmates, which is forthwith picked up, and the creatures thus stroked and pitied, and exposed to cold, and again attempts to feed and nurse them, survive their rough entrance into life by miracle. We repeat—there is no occasion to intrude upon the hen while she is hatching her brood, nor ought we to do so. The chick that requires to be assisted from its shell will be too puny to be worth the rearing. The mother may be left with safety, nay with benefit, for even forty-eight hours from the time that the chickens begin to come forth. The fine instinct with which she is endued, will enable her to perfect the work of which she has been for three weeks the sole artificer. She will assist the little prisoners, and throw away the intruding shells; she will liberate their beaks from the scale, and "*cro-o-o*" to them, and dry their clammy down, and foster them in the genial warmth of her breast, and they will be strengthened and nourished by the yolk, which is said to form no part of the chickens, but to be retained in the intestines, for the purpose of affording their first aliment. However this may be, certain we are, that a brood thus left to the mo-

ther's care, will be stout and strong when (the whole being hatched except those eggs which may be addled) the two days are expired, and quite ready for the food which has been provided for them. A coop should be put in a sunny spot, but *not on grass*; under this the hen and her family must be placed, with groats, a little barley, and clean water, in a chicken pan or a garden-pot saucer. They should be fed little and often with groats, a few grains of barley being always thrown to the mother, which she will peck and split, and call her young ones to partake of. Every day the coop should be removed to a little distance, so that the creatures may be clean and dry; and each morning too, a fresh sod of grass turf ought to be placed inside the coop for them to scratch and demolish, to obtain any worms or insects that may be lurking among the roots of the grass. It is usual for hens to be detained in their coops for a month: we object to this decidedly. Indeed, where the range is small, and the situation inclosed, we prefer that Nature should be seconded, and the maternal anxieties indulged, by setting them free after the first two or three days.

Food.—We have stated that groats are the best aliment for chickens, but they may be discontinued as soon as it is perceived that the young ones are able to eat whole barley. That food which is most nutritious, is the most proper for every animal, and will be the cheapest in the end. While we were buying our experience, we made trial of all kinds that are usually given, tail-wheat, inferior barley, sunflower seeds (of which last we grew an immense quantity, on purpose to make a fair trial of the assertion, that this food would impart the colour and flavour of game to the flesh of domestic fowls, and which we found to be a fallacy), maize or Indian corn, potatoes boiled, and barley of the best quality. It must be confessed, that Indian corn is the aliment they most preferred, but as it is now very little cultivated in this country, it is too expensive, unless within a short distance of London, Liverpool, &c., where it is imported from America. The best barley, therefore, and plenty of it, should be given with a few peas in the winter; occasionally some boiled potatoes, the latter merely to amuse them, with a few green leaves from the garden, such as cabbage, lettuce, &c., to supply the place of their favourite grass, when sultry weather may

have deprived them of that daily treat. Clean fresh water, should be their only beverage.

We abjure the system of cooping previously to killing, on several accounts; it is not necessary, it is cruel, and it induces a state of disease, instead of health. That it is not necessary, is evident from this fact, that a "barn-door fowl" has always retained the supremacy over the more grossly fed poultry of the metropolis; that it is cruel, need scarcely be pointed out to the most unobservant; that it induces disease, is a fact which will not be doubted, when weconsider that we alter the creatures' habits, debar them from exercise, and prevent them from having recourse to those instinctive enjoyments, which contribute to health. If poultry have been well fed always, they can require no fatting; if they are healthful, they are in the fittest state for the table. The longest period of confinement which we consider necessary, is three days; on the first two, we give them barley-meal instead of barley, because, being unable to procure small gravel to assist in digesting that hard food, it is better to substitute an aliment which is softer. On the third day, they should eat nothing, that is for twelve hours, before they are killed.

The horrid system of cramming, that disgrace to these enlightened times, we cannot too strongly reprobate! It is grievous to reflect upon the innate cruelty of nature which man possesses; we regret to think it innate, yet such it must be, for if it proceeded from ignorance, our educational systems ought to have instructed the community; if from the remnants of our barbaric origin, civilization and sociality should have shamed human beings into humanity! Cruelty and cowardice are inseparable; the more weak and unoffending the objects, the greater is his delight to torture them. How vitiated, too, must be the taste of those who can devour, and thereby encourage, this torture of creatures which are over fed, and consequently in a state of disease!

One of our best writers on domestic poultry, Bonnington Mowbray, Esq. (whose able work is nevertheless tinctured with irrationalities) thus speaks of this vile custom, in his "Practical Treatise on breeding, rearing, and fattening domestic poultry," page 69.

"The Wokingham method of feeding, is to confine the fowls in a dark place, and cram them with a paste made of barley-meal, mutton suet, treacle, or coarse brown sugar, and milk, and they are found completely ripe (*ripe !*) in a fortnight. If kept longer, the fever that is induced by this continued state of repletion, renders them red and unsaleable, and frequently kills them. I must presume to repeat, it appears to me utterly contrary to reason, that fowls fed upon such greasy and impure mixtures, can possibly produce flesh so fat, firm, so delicate, high flavoured, or nourishing, as those fattened on more simple and substantial food, as for example, meal and milk; and I think lightly of either treacle or sugar. With respect to grease of any kind, its chief effect must be to render the flesh loose, and of indelicate flavour. * * * * * Real excellence cannot be obtained, but by waiting Nature's time, and using the best food. Besides all this, I have been very unsuccessful in any few attempts to fatten fowls by cramming, they seem to loath the crams, to pine, and to lose the flesh they were put up with, instead of acquiring fat: and where crammed fowls do succeed, they must necessarily in the height of their fat be in a state of disease."

In and around London, the trade of fatting fowls is at once extensive and lucrative. The state of misery in which these poor victims to the cruelty and gluttony of the coarse-feeding citizens and their caterers, drag on their existence, is truly pitiable; shut in from pure air, and the enjoyments of liberty, cooped up and gorged against their will with food abhorrent to their taste; what well regulated mind does not revolt from the contemplation, and who would not rather partake of even inferior-flavoured poultry, rather than encourage a trade so degrading to humanity!

But we maintain, that the rational plan which we have detailed, will ensure a supply of the finest poultry that can be reared; thus, in discountenancing the cramming system, "virtue would be its own reward."

Our remarks on this subject being the result of experience, and our plans therefore practical, we feel no hesitation in promising the same success to all who may adopt them, which has attended ourselves. We are fond of experimenting; and

having tried every known method to preserve eggs, and found *all of them fallible*: we discovered a simple method, which we have proved to be unobjectionable. It is well known, that while the yolk of an egg remains surrounded by the white or albumen, the egg is good. Few of our readers can have been so fortunate as to have escaped that breakfast table infliction—a stale egg; and they will not fail to have observed, that on one side of it there exists no white, but that the yolk is in close contact with the shell? This alteration in the position of the vitellus or yolk is the cause of the annoyance; the shell is porous, and as soon as that portion of the egg, which is intended to constitute the food of the chicken, and is consequently liable to corrupt on being exposed to the influence of the atmosphere, sinks through the surrounding medium, which contains (and perhaps partakes of) the vital principle, and touches the shell, the process of decomposition commences.

To retain the yolk, then, in the middle of the white, is the desideratum, and this we have succeeded in achieving for many months. We had failed to preserve them in bran, sand, ashes, salt, lime-water, hanging them up in nets, and scalding them; the last named plan, however, though objectionable, is the best, excepting our own, which consists merely in turning them every day, and is thus contrived: A frame of wood, two feet long by one wide, and two inches in height, has strong copper-wire strained across from end to end and side to side, to form squares large enough to allow eggs that are of a medium size being placed in every alternate space; the wire to be twisted at each corner of the reticulation or intersection. In private families, the number of eggs will rarely exceed those of the square receptacles contained in one square frame, and can therefore be with ease turned every day, (forty or fifty being reversed in one minute); but when eggs are kept for sale, or on a large scale, hundreds could be managed in the same short time by having several of these frames made to fit on to one another with handles, so that the whole stock might be turned at once. The plan is excellent, yet susceptible of much improvement. In the event of packing eggs for sea voyages, it would be invaluable, if the slight attention they require could be commanded.

Diseases.—Of the disorders to which poultry are liable, we really are practically ignorant, having for many years been so fortunate as to experience few or no instances of disease among our stock; and we attribute the health of our various animals in the farm-yard entirely to strict attention to cleanliness, diet, and rational treatment. Those who listen to the advice of the ignorant and prejudiced, nay, they who seek from books remedies for disorders which may appear among their live-stock, will have to contend with monstrous absurdities, excessive ignorance, and barbarous cruelty, in the quackeries recommended. Nature will generally effect a cure, if her efforts are seconded by simple means on our own part. Calomel, sulphur, rue, pepper, and gin, are all absurdities, though all recommended for the ailments of poultry.

Ducks.—Large-bodied and dark-feathered ducks are generally finer flavoured than those with white plumage. It is not usual for these birds to lay more eggs than they can hatch, though occasionally, a valuable individual may be found in a district, whose wonderful achievements in laying, as well as hatching, two and three broods in a year, are recorded.

Their indications of a wish to incubate, though not so obvious as those of hens, are nevertheless sufficiently marked; and no one who is not very unobservant, can be deceived. We are averse from the plan, of placing duck eggs under a hen to be hatched. It is not only cruel, to keep the poor bird a whole week longer in her office (for they require that extra period), but nature is thwarted in those fine instincts of that proud and happy period of her life, by the untoward habits of her nurslings. A pond is not essential for the well-doing of these fowls If a large shallow tub be sunk in a convenient spot of the premises, to which the old birds can have access, in order to dip and wash themselves daily, it is all that will be required; and indeed, young ducklings ought not to be permitted to go to any water for the first six weeks, excepting that contained in wide shallow pans, in which they will dabble occasionally without injuring themselves; whereas, if they were allowed to follow their mother to a pond, they would remain too long, and be liable to become cramped.

The same objection exists, with respect to cooping ducks upon grass, which attends that locality for chickens, namely, danger from damp. We cannot too strenuously impress the necessity to guard poultry from exposure to moisture; dry cold, however severe, is seldom inimical to them. If the coops be placed on grass, even in hot and arid weather, there are heavy dews in the early morning, into which these little creatures will *wander*, *draggling* their downy covering, and ensuring an almost certain death from cramp, or, if ducks, from that complaint locally and vulgarly called "the sprawls." It is very desirable, however, that they should be admitted into a field for a few hours every day, when the weather is dry. Barley-meal is the best food for ducklings. It should be frequently renewed, as well as fresh water in their pans, as often as they shall be emptied by the splashings and dabblings of the little brood. Straw should be placed in a coop with a duck, but not with a hen, as the young ones of the former being constantly wet, require to be dried as well as warmed, when they retire to the shelter of their mother's breast for occasional repose. As the ducks approach to full growth, one of their three daily meals should consist of whole oats, which must be thrown into a pan of water, for this food they will seek with avidity and delight; their natural manner of feeding will be thus imitated, which is effected by *sifting*, as it is called. The fine network at the edges of their bills suffers the water to pass through, but retains whatever particles of sustenance may be floating in the fluid.

Ducks are more easily and pleasantly reared than chickens; for unless the fences round the gardens and pleasure-grounds are close and high, the latter will infallibly effect an entrance, and distort the gravel-walks by their vigorous scratchings, much to the discomfiture of a gardener's equanimity.

We repeat, that good, nay, *high feeding from the first*, is the best way to obtain fine, firm, full-flavoured birds; to say nothing of the comfort that a proprietor must derive, from the certainty that those creatures over which he has controul are in the enjoyment of the few requisites which constitute their happiness.

Geese.—What is more delicate than a young well-fed goose, from September till January; what more rank and detestable

ıan an old, tough bird, quickly fatted on the greasy abomina-
ons that constitute the food of those which are too frequently
› be met with at a poulterer's. It is quite a mistake to sup-
ose that a Christmas goose *must* be coarse and strong: those
'ho depend upon a purveyor will rarely find it otherwise, we
dmit; but they who have reared these birds, and attended to
ıeir regular feeding, can refute the assertion. If it be desir-
ble to fat two or three, with the intention of enjoying the treat
t that festive season, without the trouble of hatching a brood,
'e would advise that the number be purchased from a flock half
rown, at the beginning of autumn. It is not necessary for
hem to have access to a pond, a deep pan or trough, constant-
y, that is daily, supplied with fresh-water, will be sufficient.
'hree feeds, one of barley-meal, one of dry barley, and the
hird of oats, every day, and water only to drink, should be
heir sole aliment for the last fortnight of their existence; be-
ore that time they should have the run of a common or some
'aste piece of grass, for of this green food they eat largely;
ut they make a pasture unbearable to animals, therefore should
ever be admitted where cattle are grazing. During the last
'eek or two, they may be confined during the day within four
ıurdles (which ought, for the sake of cleanliness, to be removed
very alternate day), and driven under shelter at night. As
hey are social birds, they will not thrive alone, two or more
ıust be fatted together, or they will pine and lose flesh rapidly.
l lag, as it is locally termed, consists of a gander and five geese.
f the spring be mild, the latter will evince indications of wish-
ng to sit, in the open weather of February, when a bundle of
lean straw should be placed in an open shed, of which they will
roceed to construct their nests, side by side, without requiring
ny assistance or attendance. It is surprising that any mystery
hould be made, or difficulties thrown in the way, of so simple a
ıatter as rearing poultry; nothing can be *more simple* or cer-
ain to succeed, where a few rational rules are kept in view, and
ttended to. Cleanliness, dryness, kindness, and full feeding,
re the secrets of success. Geese grow with great rapidity,
nd require a large quantity of food, and at frequent intervals;
ıdeed, what young creature is an exception? Children ought
o be allowed as much nutritious simple food as they desire;

adults require less in quantity and at longer intervals. The treatment of a goose with her young brood ought to be the same as that which we have detailed, for the duck, substituting (for a coop) a crate, such as glass and china are packed in, with a sack or mat thrown over the top, to protect them from rain. Barley-meal to be the first food.

Plucking.—Suffering of all kinds, especially unmerited suffering, among those unoffending creatures, which we make subservient to our wants, is always distressing to an unvitiated nature; it behoves every one, therefore, to discountenance the tendency to inflict pain, in which hard natures and mercenary beings are apt to indulge.

We cannot place the cause of the unfortunate geese in better hands than those of the humane writer whom we have before quoted; he thus speaks of the wicked practice of plucking them:—"The goose is a considerable object of rural economy, and kept in large flocks, in the eastern and fen counties of England. In some of those parts their geese are exposed to the cruel operation of being annually stript of their feathers, and it has been said that fowls plucked alive have been sold in the markets at Edinburgh. Indeed, the interested feelings of man know no scruple, and the cruelties practised upon the poor sea-fowl, which have their down and feathers torn from them, and are then cast into the sea to perish, are enormous, and yet it would seem irremediable. Not so the disgusting barbarity, under the insane idea of sport, formerly, perhaps even now, practised in Scotland. These harmless fowls are hung up alive by the legs, and savages, men and boys, ride at them full speed, catching them as they can by the neck; and there can be no doubt that the horribly pleasing process of roasting a goose alive, as detailed by Dr Kitchener in his "Cook's Oracle," a book invaluable equally to the gourmand and the economist, was actually practised in former days; indeed, we have proofs innumerable, and utterly disgraceful to this enlightened nation, of the absolute necessity of amending the enthusiastic and indefatigable Martin's bill, and rendering it completely comprehensive. It would have the effect of teaching men to think and feel, and to be convinced of the horrible and unnatural error of deriving pleasure from the rack-

ed and tortured feelings of other animals, endowed with feelings similar to their own. A writer in the Monthly Magazine, December 1823, remarks humanely on the cruelty of plucking living geese, proposing a remedy which I should rejoice exceedingly to find practicable and effective. He remarks on the additional torture experienced by the poor fowls, from the too frequent unskilfulness and want of dexterity of the operator—generally a woman. The skin and flesh are sometimes so torn as to occasion the death of the victim; and even when the fowls are plucked in the most careful manner, they lose their flesh and appetite, their eyes become dull, and they languish in a most pitiable state, during a longer or a shorter period. Mortality also has been periodically very extensive in the flocks of geese, from sudden and imprudent exposure of them to cold after being stripped, and more especially during severe seasons and sudden atmospheric vicissitudes. The remedy proposed on the above authority is as follows:—feathers are best of a year's growth, and in the moulting season they spontaneously fall off, and are supplied by a fresh plumage. When, therefore, the geese are in full feather, let the plumage be removed close to the skin by sharp scissors, the produce would not be much reduced in quantity, while the quality would be greatly improved, and an indemnification be experienced in the uninjured health of the fowls, and the benefit obtained to the succeeding crop; labour also would be saved in dressing, since the quilly portion of the feathers, when forcibly detached from the skin, is generally in such a state as, after all, to require the employment of scissors."

The Pintada, or Guinea-fowl.—This bird is much esteemed for the fine flavour of its flesh, which more nearly resembles that of the pheasant than any other, and is in season when the latter is out of request. *It is said* to be reared and domesticated with greater difficulty than the usual inmates of the poultry-yard. This is not the case; nor is it "delicate when first hatched," as writers assert. It, however, is more wild in its nature than other fowls, straying to a distance, and depositing its eggs under hedges, among furze, or even in the most exposed spots, where every chance passenger may more readily obtain possession of them than can their owner.

We prefer to intrust a brood of pintadas to the care of a common hen, rather than to that of its own species. Their habits are not dissimilar,—as is the case with the duck,—and her nature will not be outraged in bringing them up. A hen will, with ease, cover seventeen or eighteen pintada eggs, as they are smaller than those of the common fowl.

We repeat, they are not difficult to rear; we have never lost a chick, except by accident. In consequence of their small size and minute beaks, it is requisite that their first food (groats) should be broken for them. They are exceedingly fond of, and thrive rapidly on ants' eggs,—whole nests of which should be sought for, and brought to them with a shovelful of the mould in which they are found. This, if thrown partly within the coop, the mother will amuse herself with scratching while she at the same time instructs her chicks to seek for their own sustenance.

We have been surprised to find, that in books professing to give the natural history of this bird, its disposition should be courageous: it is the most remote from courageous; it is cowardly, fierce, and tyrannical in the extreme. These birds persecute all other inmates of the poultry-yard, with relentless perseverance, *but always in a body.* We were on one occasion witness to an assault upon a solitary pullet, by eleven pitadas. They surrounded their victim, pecking it with violence, and whenever one of the inner range of assailants received a blow from the poor bird, it retired to the outer circle. A very few minutes would have sufficed to destroy the pullet, but fortunately, the dastardly creatures were driven away. Their beaks are remarkably strong and sharp when they are full grown.

Their cruelty to all other poultry passes imagination. While among themselves they are placid and affectionate; hence they ought either to be kept in a separate yard, or, if that arrangement be inconvenient, the stock of poultry ought to be confined to these birds, or they should be rejected.

The treatment of pintadas differs so little from that of other fowls, that, with the foregoing remarks, we close the subject.

Turkeys.—The following observations and method of rearing turkeys are not the results of our own experience; but are from the pen of the gentleman above quoted. We have refrained

from keeping them, being deterred by fear of the trouble and difficulty which writers have thrown in the way; though, in consequence of the gratifying success which has attended us in our other feathered stock, we have no doubt our attempts would have been equally satisfactory, as we have always *of late years* taken nature for our guide, and endeavoured to treat them rationally. For example, although we have Mowbray's authority for the practice, we would not "withdraw the chicks from the nest, and keep them very warm." Turkeys are amenable to the same wise laws, that the common hen obeys; hence we should leave them to the more congenial warmth of the mother's breast. Indeed, we are no sooner instructed by this author to remove the chicks, than he renders the advice nugatory by saying, "The turkey, from sitting so close and steadily, hatches more regularly and quickly than the common hen." (!)

Who removes the chicks to a warm situation when the mother steals a nest, or is in a state of nature?

In the article of food, we have equal contradiction, as well as absurd directions; the chicks are to have curd, eggs boiled hard and chopped fine, oat or barley meal kneaded with *milk*; yet immediately afterwards adds—"milk is apt to scour them;" then why give it? Water is their natural beverage, and will *not scour them*. Then, in case of cold weather ruffling their feathers, they are to have half-ground malt with their meal, "and, by way of medicine, caraway, or coriander seeds." (!) Nor must we omit "artificial worms, or boiled meat, pulled into strings, in running after which, the chicks have a salutory exercise." (!!) He justly observes afterwards, that "superfluous moisture, whether external or internal, is death to the chickens, therefore all slop victuals should be rigorously avoided;" and in this remark we cordially agree.

Pea-fowls, tame pheasants, partridges, &c. we candidly own, we know nothing of practically, and, as they are only kept for amusement, abstain from introducing any observations on their treatment from the same work.

ON THE CULTIVATION OF BOG BY AN ARTIFICIAL SUBSOIL.

By Mr Samuel Nicholson, Dublin.

Communicated by C. G. Stuart Menteath, Esq. of Closeburn.

Having been engaged on the Government valuation of Ireland since I last had the pleasure of seeing you at Closeburn, now some years ago, I have had ample opportunity of examining bog; and in consequence of an agricultural and engineering tour in the south and east of England in the summer of 1835 (more especially in the Fens) my attention has been drawn pretty closely to the subject.

A great deal has from time to time been said and written on the reclamation of bog, some advocating the floating away of the surface, where the subsoil is good, as in the case of the Drummond Moss in Scotland; another recommending draining and the application of earth, as in the case of Chat Moss in Lancashire; a third proposes irrigation; while a fourth says that shallow-draining, paring and burning, tilling and laying down with grass-seeds, is quite enough to secure a fair return for capital expended upon *any bog*.

I shall not say much upon any of these methods, but I have little hesitation in asserting, that for one successful attempt which has been made in the cultivation of flow bog, like that of the bog of Allen in this country, Lochar Moss in my native country, or Chat Moss in Lancashire, there have been twenty failures. Indeed, I have yet to learn whether Chat Moss improvements themselves have paid, notwithstanding favourable locality, and all that has been said about them. No doubt floating off the surface, where the subsoil is good, is a safe method, but then we lose the fuel, and if we only look at the accelerated rate at which our coal-fields are being exhausted, it becomes an object of great national importance to preserve our turf as much as possible. Irrigation is no doubt very often a desirable method, but like floating it is seldom practicable. The fourth method, draining, laying on earth, &c., has been often tried and is still recommended, but any one who chooses to visit Chat Moss, may see that bog so reclaimed has a tendency to revert to its natural state, and requires top-dressing to prevent it. This,

I am of opinion, arises from the want of an *earthy subsoil*, which I take to be the *great evil in all bogs*, the *main barrier to successful improvement.* With regard to improving *red-bog* by draining, paring, and burning *alone*, I confess I have never *seen* a successful instance of it; for, besides the necessity of an earthy subsoil, I think I could shew that we must have earth in the soil itself, especially if we intend to cultivate white crops; I grant that it is not so necessary for meadow and green crops.

Before saying more upon this subject, I shall take a hasty glance at the nature of the various kinds of bogs and fens which I have met with. I think I have discovered three pretty distinct classes of peat *formations*, to use a geological term. First, That which chiefly occurs on the sides of mountains, and is composed of the decayed roots and stems of heath and coarse grass. It varies from a few inches to three or four feet in depth; is of a dark brownish-black colour; contains some earthy matter; and produces heath and coarse grass. For want of a better term I shall call it *Mountain Bog*, though it occurs sometimes in low countries where the substratum is not very retentive.

The second class is that which has been formed on the scite of lakes or in stagnant, or comparatively tranquil, water, and is composed of the decayed stems and roots of aquatic plants. It is of a blackish colour, contains a considerable portion of earth and also animal matter, and generally, in its natural state, produces coarse aquatic plants. This variety I would denominate *Lacustrine Bog* or Peat. The fens of Lincolnshire and Cambridge are mostly of this description, and are the most profitable kind of peaty soil we have.

The third class is a well-known kind, named *Flow* or Fibrous *Bog*, and is composed of numerous species of decomposed or decomposing moss-plants, among which the *Sphagnum* predominates. It is deep, wet, and spongy; remarkable for its antiseptic quality, and absence of earthy ingredients. It is commonly met with in low flat situations, though sometimes on the sides of mountains, where the subsoil is retentive; but stagnant water, which encourages the growth of the mosses, appears to be the chief cause of its generation. Many of them appear to have grown upon the surface of class second. The Bog of Allen is of this kind, so also is a great part of Lochar Moss and Chat Moss.

The practicability of improving this kind of bog is a subject which, you are well aware, has engaged the attention of the most eminent agriculturists. Many, after trial, have given it up as hopeless. Fortunes have been expended, and ruin has been the consequence. To offer a new mode for the improvement of this kind of bog, as well as that of the worst kind of lacustrine bog, is the chief object of this communication.

We are well aware that the lacustrine or fen bog is the most profitable of all the three classes, and this, I presume, is easily accounted for. It is better decomposed, less astringent, more consolidated, and contains more earth and animal matter; qualities which it appears to owe to the peculiar circumstances under which it was formed. If, then, we can by any means so alter the nature and composition of the flow-bog as to make it approximate to that of the lacustrine bog, we shall have made a successful step towards its amelioration, and this I think can be done.

In order to effect this, I would follow to a certain extent the example which has hitherto been set by the most approved bog-reclaimers, namely, drain to get quit of the astringent water, to destroy the growth of the bog, and to consolidate it. Then apply earthy material and quicklime, &c., to bring it into a state of decomposition, and to assimilate it to the nature of our more prolific soils. All this, and no more, *has been done already*, and yet it is found inferior to the lacustrine or fen bog, and is still considered a dangerous subject for the investment of capital. The cause of this is a subject worthy of inquiry, and one which does not appear to have been hitherto accounted for. The following is my view of it.

Although we may have succeeded in assimilating the *soils*, still there exists a *material difference* between the *subsoils*. In the case of the lacustrine bog, there is more or less *earthy matter to the very bottom*, by which a due circulation of moisture is promoted, a circumstance which, in my opinion, is of the greatest importance to both soils and subsoils. But in the case of the flow-bog, all below the soil is a *mass of dead inert peaty matter*, almost impervious to moisture and air, and the moisture it does contain must be of an astringent and pernicious quality, and injurious to vegetation.

In order to remedy this evil, I would propose, after the bog has been drained and consolidated, to lay an *artificial subsoil of clay, sand, and gravel*, three, four, or more inches in thickness, at the depth of about eight inches under the surface, so as to cut off all connexion with the lower portion of the bog. By this means, all the pernicious moisture rising from below will *undergo an important chemical change in its passage through the subsoil.* The subsoil will also make the soil more firm, and whenever we see bog resting on a sufficiently earthy subsoil, we generally find it productive, unless the soil is very ferrugenous. The manure will have more effect. The soil will decompose more freely, especially if an inch or two of its surface has been burned, and it will ultimately be converted into a rich moory loam, fit for the cultivation of most crops, especially if it has had a due admixture of earthy matter, and certainly in the case of an artificial subsoil much less will suffice.

If, then, my views are correct, this would be a permanent improvement to bog, and on that account would amply repay any additional expense which would be incurred over ordinary methods, which, in fact, have been mostly found ineffectual. I have little doubt that a fair trial would, in a few years, demonstrate its complete success, and thus, by-and-by we would see some millions of acres, of dreary, dull, worthless, waste bog, converted into rich smiling corn-fields and meadows, and the climate improved. I allude more particularly to Ireland. It is a remarkable fact, that wherever bogs occur, especially in this country, the elements for their improvement are at hand. We have here in our diluvial deposites the best of clay, gravel, and sand, for the purpose, being chiefly of a calcareous nature. On the verge of Lochar Moss, if my memory is correct, are deposited abundance of materials from the greywacke and new red sandstone formation, admirably adapted for its improvement. As a means which this would afford of ameliorating the condition of the labouring classes of this *naturally* highly-favoured country, it is superfluous to speak.

In concluding this communication I would beg to say that hitherto, in my opinion, the importance of subsoil has not been duly considered, either by theoretical or practical agriculturists. We drain, to be sure ; but that is almost all we do towards the

improvement of retentive clay subsoil. I am of opinion that simply loosening the subsoil either with a pick or a particular kindof plough, would bean advantage where there are no springs; and certainly mixing the clay with almost any kind of gravel or sand when too retentive, would be a greater advantage still, by absorbing the superabundant moisture, destroying its acidity, and in opening the soil itself. On the other hand, light gravels upon gravelly subsoils might not only be improved permanently by mixing clay with the soil, but also with the subsoil.

It is remarkable that such men as Sir H. Davy, when speaking of the composition and fertility of different soils, scarcely ever allude to the subsoil; but appear to think, that their "fertility depends upon the state of division and mixture of the earthy materials and the vegetable and animal matter." No doubt a good deal depends upon this, but a good deal will also depend upon the nature of the subsoil, and what may constitute a fertile soil upon one kind of subsoil may be the reverse upon another.

When conversing with Mr Griffith, I mentioned this plan of improving bog to him, and I am happy in saying that he has some idea of trying it on the Crown lands of "Pobb O'Keefe," county of Cork, where he is making improvements for the Government. I visited that place in 1836, but there is very little red bog there. I am anxious it should be tried in Scotland.

THOUGHTS ON DRAINING AS A SOURCE OF NATIONAL WEALTH.

There will be little difficulty in shewing, that thorough draining might be made a source of wealth to the nation, after having proved that capital may be profitably invested in it by individuals, for individual is synonymous and simultaneous with national wealth. The statements of profits which we submitted in last number, both from a landlord and tenant, though highly encouraging to other landlords and tenants for imitation in similar situations, were derived from the improvement of very unpropitious soils. The estate of Cleland, we understand, lies in the Upper Ward of Lanarkshire, at a high elevation, and amidst

discouraging circumstances for improvement; and it is well known that the country to the southward of Tranent, where the farm of Wintonhill is situated, generally rests on a retentive clayey subsoil; and yet in both those unfavourable situations, thorough-draining has been, and is prosecuted to the entire satisfaction of landlord and tenant. It is very true, that it is in naturally the most discouraging circumstances for culture, that thorough-draining manifests its peculiar power of drying land in the most striking manner; but it does not follow *a priori* that it will in every case dry land, and yield a profitable return. On the contrary, the necessarily large expenditure required for thorough-draining greatly lessens its apparent probability of profit. Nevertheless it is pleasant to the feelings to contemplate agricultural improvement, whether it have repaid its cost or not, yet we may presume it is only the certain attainment of profit, the amount of which is best known to improvers themselves, that can stimulate to further prosecution of thorough-draining. When we, therefore, see field improvements successively prosecuted with energy, and for lengthened periods, we may reasonably conclude they are remunerative. We may, at all events, surely assert, that they have been, or eventually will be, remunerative. It is possible that the immediate improvers themselves may not be remunerated for their outlays if the improvements have been conducted on an extensive scale; but improved land will certainly return in produce an equivalent for the capital expended upon it. This result, though certain yet being prospective, may fail to operate as a direct encouragement to improvement, but it supports a well grounded hope. It is at least a bond of security to landlords for the ultimate solvency of their tenants; and possessing such a permanent and inalienable security, landlords should always be considerate, nay, indulgent to tenants who have expended capital in the *permanent* improvement of their land. This indulgence is manifested with the greatest kindness and received with most gratitude by the renewal of the lease.

It should, however, be held in remembrance, that field improvements are undertaken under various motives; for variety of motives of course actuate farmers in the management of their farms, as strongly as others are actuated in ordinary

business. All those motives are no doubt more or less tinged with selfishness, for perhaps no field improvements are prosecuted out of mere regard for the improvements themselves. When a proprietor improves he is desirous of either beautifying the natural deformities, or drawing forth the natural beautise of his property. When a farmer improves, the primary object he has in view is the support of himself and family. There are various ways of gratifying this motive. One farmer is desirous of accumulating wealth in youth or manhood, in order to enjoy ease and comfort in his declining years; and he conceives he attains his object most effectually by increasing the productive powers of the soil. Another finding domestic expenditure to exceed the income derived from the farm in its current condition, stimulates the soil to increased productiveness as the only means within his power of releasing himself from domestic embarrassments. A third, ambitious of acquiring the fame of eminence in agriculture, perceives that superior excellence in the management of soil and stock is the surest way of attaining his high object. Whilst a fourth undertakes, at a tempting rent, the management of a farm put into great disorder by the negligence and ignorance of his predecessors, and hopes to realize a fair competency by good farming. Whatever be the motives that actuate farmers to improvements, identically the same results are produced in the increased productiveness of the soil; but those motives must be imperative, or farmers would never suffer themselves, their labourers, and horses to undergo, for a length of time, the numerous inconveniences necessarily attendant on all field improvements. The collecting of stones and depositing them into the drains—the filling in of the drains, and smoothing again the surface of the field—the driving of large quantities of lime and manure from a long distance—all these extraordinary operations, prolonged perhaps over years, and imposed on the ordinary working strength of the farm over and above their ordinary labours—form daily harassments, the irksomeness of which could only be supported by the hope of recompense in pecuniary emolument, or elevation of character, or they would not willingly be endured by men of easy temperaments and limited capital.

Let us consider what is the recompense for which farmers toil their bodies, task their minds, and expend their capital. Good culture has much enhanced the productiveness of the soil since the general war. Since that period we may safely aver, that barley in this country has increased in produce 12 bushels per acre. The produce now is as commonly 54 bushels per acre, as it was in the war 42 bushels. This is equivalent to an increase of about 28 per cent. Other species of grain, as wheat and oats, have perhaps increased in produce in as great a proportion. The general reduction of rent in this country is admitted to be about 25 per cent. since the war; and as rent presupposes not only the possession of the crop, but the expense incurred in raising it, we must add the reduction in rent to the increase of produce, which conjoined confer on the farmer at present an apparent advantage of 53 per cent. over what he enjoyed during the war. But, on the other hand, the fall in the prices of corn has nearly counteracted these advantages of fall of rent and increase of produce. The average annual price of wheat from 1800 to the end of the war in 1815, a period of sixteen years, was 112/9 per Winchester quarter; but from 1816 to 1836 inclusive, the average annual price was only 65/6, indicating the annual average fall in the price of wheat to be about 47 per cent. Deduct the disadvantage of 47 per cent. of fall in the price of wheat, from the advantages of 53 per cent. of fall in rent, and the increase of produce combined, and only 6 per cent. remain to the farmer for repaying him the risk of capital incurred in his profession. Farming is thus not a lucrative profession. A mere immunity from loss is we believe the most favourable estimate that should be exhibited of the present condition of the Scottish farmer. So that had it not been for his own exertions in improving the fertility of the soil, his present position could not possibly have been maintained from reduction of rent alone.

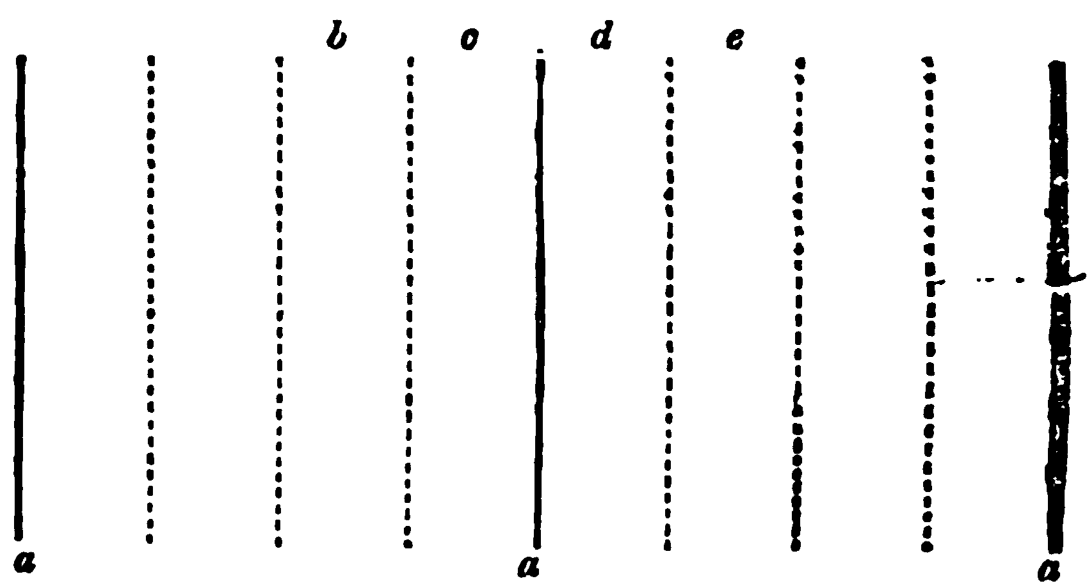
But, ere his position attained its present tolerable condition, he passed through a fiery ordeal. The war left him with ample capital, but the war prices also left him with cruel abruptness. After the high prices of wheat in 1816 and 1817 had subsided, and which were solely maintained at an adventitious height by the very bad crops of those years, and bad crops it is well known are of no advantage to the farmer, the

prices in 1818 fell to 84/1, and so on successively each year from 73/, 67/11, 56/2, to 44/7 per quarter in 1822, in the course of only five years. Such astounding successive falls threw the farmers into despondency, for, by that time, the capital accumulated during the war had dwindled away to meet urgent obligations; and the landlords, for the same reason, were thrown into consternation, for even if they could have waived their right to levy rent altogether, in order to alleviate the depressed condition of their tenants, exemption from payment of rent could not alone, as we have shewn above, have averted the farmer's ruin. In the midst of these difficulties some farmers cherished the hope of again receiving the former high prices, when the convulsion, as they were deludingly told, of a sudden transition from a state of war to that of peace, would pass away. Others, with more wisdom, set diligently to work, to abstract more produce from the land by a beneficial system of farming, and could they but succeed in their endeavour, they conceived they would be as well repaid with lower prices as with less produce at higher prices. This wise resolve, in many cases determined on in time, proved a great stimulus to industry, and its favourable issue has terminated in the increased produce of 12 bushels of barley per acre.

If this mode of argument is at all based on truth, and we maintain that it is, we may conclude that the most favourable view that can be taken of the Scottish farmer's present condition is mere immunity from loss. But could means be devised still farther to increase the productiveness of the soil, could other twelve bushels of barley per acre, for instance, be added to the farmer's crop, by means which would repay the expense of attaining the additional produce, his condition would thereby be much improved,—not improved, to be sure, to the full extent implied in the increase of twelve bushels per acre, for so large an increase of produce would have a sensible effect on prices, but to the extent of again rendering farming a lucrative profession. Now, we firmly believe that thorough-draining would increase the present productiveness of the soil to the extent of twelve bushels of barley per acre. This belief is not founded on mere conjecture; it has been derived from experience, founded on experiment. Thus, a certain farmer conceiving that

draining even retentive subsoil, in every furrow was attended with more expense than any anticipated increase of produce from the soil would warrant, put a drain in every fourth furrow, and as each drain, in that case, would have much farther to draw than a two-feet drain in every furrow, he caused them to be dug four feet in depth. Each drain had thus to draw across the breadth of two ridges on either side of it. The drains did certainly dry the two ridges, one on either side of them; but that they did not equally dry both the two ridges on both sides, which it was the object of the experiment to effect, was clearly evinced by the great difference in the crops produced on the ridges farthest from and nearest to the drain,—the nearest ridges bearing nine bushels per acre more produce than those farthest off. As the result of this experiment is highly important in shewing the evident superiority of real thorough-draining, that is by running a drain up each furrow, we shall illustrate what we have just stated, by this cut, fig. 1. where *a a a* represent

Fig. 1.



sent the four-feet drains in every fourth furrow. It is evident at the first glance that the middle drain *a* has to dry four ridges, *b*, *c*, *d*, and *e*; and the consequence is, the two ridges *c* and *d*, next the drain *a*, produce nine bushels per acre more than the two ridges *b* and *e*, farthest from that drain. It is possible that the drain *a* also affects the partial drainage of the distant ridges *b* and *e*, and that being the case, and drains not having been run on each side of the same ridge, the absolute drying powers of such four-feet drains cannot be exactly ascertained. By this experiment it can only be ascertained that one probably thorough-drained ridge such as *c* or *d* bears nine

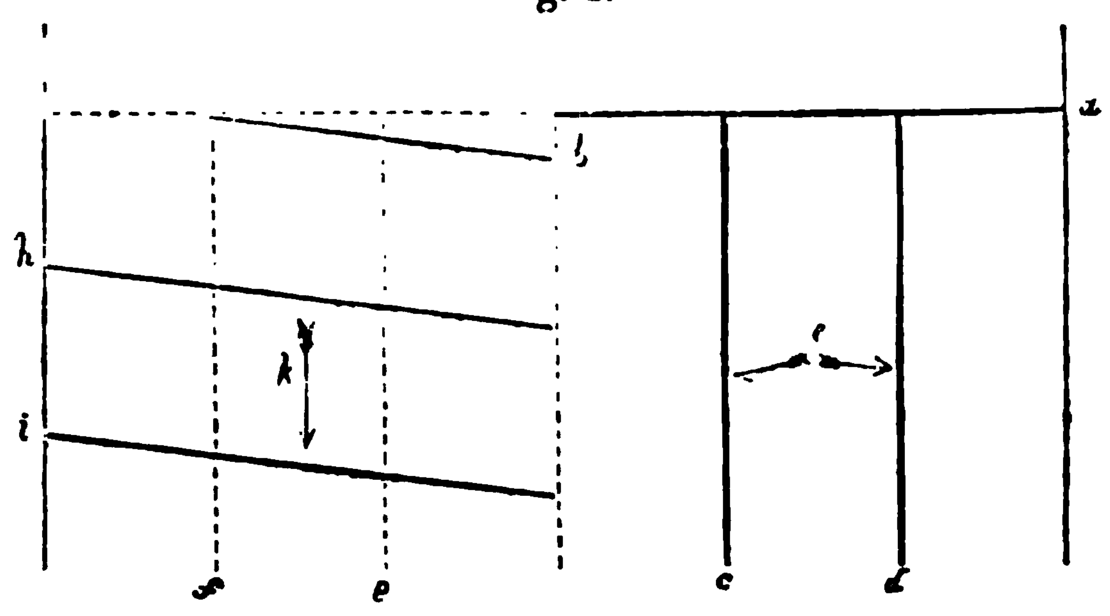
bushels of corn more than another ridge beside it *b* or *c*, not so thoroughly or only partially drained, but it does not indicate the full advantage gained by thorough-draining over the same land in an undrained state. Judging, however, by the produce of the probably thorough-drained land over that partially drained to be nine bushels of corn per acre, we may safely conclude that the increased produce of thorough-drained over land not drained at all, will be twelve bushels per acre,—and this is just the result we wished to arrive at. Had the field experimented on as above been thorough-drained by a two-feet drain up each furrow, instead of a four-feet drain in every fourth furrow, we have no doubt its whole produce would be increased twelve bushels per acre more than it ever carried in an undrained state.

Taking, then, twelve bushels per acre as the probable increase of barley and oats by thorough-draining, the advantages accruing from that kind of draining, in a national point of view, may be exhibited in this manner. It is assumed by Macculloch in his Statistics of the British Empire (taken, we presume, from Sir John Sinclair's statement), that 280,000 acres are annually cultivated in Scotland with barley, and 1,275,000 acres with oats. The increase of barley on the above data is 420,000 quarters, which, at 30/ per quarter, give an annual increase in money of L.630,000; and that of oats is 1,912,500 quarters, at 25/ per quarter, give L.2,390,625, together L.3,020,625. A proportional advantage by adopting the same system of draining might accrue to England and Ireland. But the advantage is not confined to barley and oats, or even to all the kinds of grain in common cultivation, but extends to green crops and pastures, and through them to every kind of live-stock. In this way the effects of the smallest exertions of individual farmers assume a national importance.

We observe that a considerable difference of opinion exists, regarding the comparative efficacy of two modes of thorough-draining land having a considerable acclivity, the one by running the drains up each open furrow of the ridges, and the other across the ridges in a sloping direction to the right or left, the distances between the drains being the same in both cases. Some persons maintain that the drains across the face

of the acclivity must intercept the descent of the water more effectually, than those placed in a direction parallel to the water's descent. This opinion seems to be founded on the supposed analogy between drying land by thorough-draining, and drying it by the interception of springs. Where true deep-seated springs burst forth on the face of an acclivity, it is evident, that a deep drain cut through the pervious stratum or strata, in the line of the outburst, and having a declination for the descent of the intercepted water, is the simplest and most obvious method of draining such springs. The intention of thorough-draining, on the other hand, is to afford numerous opportunities for rain-water transcolated through the arable furrow-slices, to run away and not be retained in a state of stagnation. Between those two different purposes, there is no direct analogy, and consequently the reasoning applicable to the one kind of draining is inapplicable to the other. Getting quit of this false analogy, and tracing the passage of the water through the earth towards the drains, on physical principles, the greater drying powers of the furrow-drains appear manifest. The annexed cut, fig. 2. demonstrates this point in

Fig. 2.



a satisfactory manner. Let the figure represent a portion of a field having a considerable acclivity, in a part of which *c* and *d* are drains cut in the furrows of the ridges, *a*, *e*, *b*; and in another part the drains *h* and *i* are cut in an oblique direction to the ridges *f* and *g*; the distance between *h* and *i* being equal to that between *c* and *d*, whatever that may be. It is evident at the first glance at the figure, that the rain falling on the ridge *e* will run towards each of the furrows or drains *c* and *d*, in

the direction of the arrows from *e*; that is one-half of the water will run into the drain *c*, and the other half into the drain *d*, and so, in like manner, will the rain-water falling on every other ridge, run. Now the water falling on the ridge *k* will have to run across the whole space from *h* to *i* in the direction of the arrow *k*, before it can find a drain to enter in; that is, the drain *i* will have to dry the whole ridge from *h*, instead of half the ridges as at *c* or *d*. These results must ensue whatever be the breadths of the ridges or spaces, or depths of the drains.

We also observe that, in some people's minds, the terror of the baneful effects of the *pan* operates as a bugbear against the benefits of thorough-draining. No apprehension is founded on a more slender basis. For how is pan usually formed? It is a deposition of ferruginous matter, occasioned by the infiltration of water, holding an acid in solution, through a stratum of earth containing iron. The deposition is usually formed on a substratum neither wholly pervious nor impervious to water; but which itself eventually obstructs the transcolation of water through the substratum. The substratum usually consists of compact gravelly clay, supporting a soil of moory or peaty origin. Bog iron-ore, and probably pea-ore, too, is formed in similar circumstances. There are three subspecies of bog iron-ore, and according to Werner they are formed in the following manner, and their formation may throw some light on the origin of pan.

"The water which flows into marshy places is impregnated with a vegetable acid, formed from decayed vegetables, which enables it to dissolve the iron in the rocks over which it flows, or over which it stands. This water having reached the lower points of the country, or being poured into hollows, becomes stagnant, and by degrees evaporates; the dissolved iron being accumulated in quantity by fresh additions of water, these follow successive depositions, which at first are yellowish, earthy, and of little consistence, and this is *morass-ore*, but in course of time they become harder, their colour passes to brown, and thus *swamp-ore* is formed. After the water has completely evaporated, and the swamp is dried up, the swamp-ore becomes much harder, and at length passes into *meadow-ore*, which is already covered with soil and grass." *

Water, we thus perceive, is the origin of those new formations of iron-ore, and pan is certainly nothing more than an

* Jameson's Mineralogy, iii. p. 297, edit. 1816.

incipient ore of iron. Stop the slow infiltration, and the consequent evaporation of the water, by offering the water a quick and free passage in drains, and the ferruginous deposition will cease; the pan will not only cease to be formed, but will no longer be nourished and retain its impervious character. The air will act upon it in its site after draining, with an effect opposite to that of water. But ought not the pan be broken up after draining? Break it up by all means, and *expose* it to the influence of the air, with the common plough if it can reach it; if not, with the four-horse or trench plough; but if that cannot reach it, then let it lie, it will do no harm to crops at that depth in dried soils. But if it cannot be reached to be broken up, how long will it retain its imperviouness after draining? It is not easy to answer this question in precise terms, since the subsoil is tangible only once during the rotation of crops; but of this we may be assured, that *when* thorough-draining is found to *dry the soil*, the pan will no longer be injurious to crops, since it was *its* retentiveness of water that urged the prosecution of thorough-draining, in order to destroy that retentiveness.

ON A SYSTEM OF GRAIN-RENT.

By Mr Robert Pillans Newton, Hallyburton, Coupar-Angus.

There is perhaps no subject connected with agricultural affairs, which has given rise to so much discussion and difficulty of late years, as that of the adjustment of rent between landlord and tenant.

During great part of the late war, the demand for land to farm was such, as at last to raise rent in many instances to a most exorbitant pitch. The protracted period of endurance of that war, led to a gradual increase in the value of all kinds of agricultural produce, and farming land seemed to many at that time, to hold out so sure a prospect of wealth, as to induce individuals, in many cases, to leave very different pursuits to embark in country affairs. The consequence naturally was, that the competition for farms, when vacancies occurred, became

greater and greater. The landlord took the best return for his land he could get, and rack-rents were, in this state of things, too often to be met with.

When the gradual termination of the war began to have the effect of bringing prices somewhat to their natural level, the difficulties and embarrassments which ensued to a great proportion of the agricultural interests of the country, are well known. Rent-day came, and the tenant was at the discretion of his landlord. A voluntary deduction was at one time given, at another, a mere toleration of the debt, without any absolute cancelling of it.

These circumstances, therefore, soon proved the necessity of discovering some mode of adjusting the rent of land, by which, while the landlord's interest should be kept steadily in view, both proprietor and tenant should be secured against the evil of any sudden change in the markets, by making the rents of land in some degree subservient to the rise and fall of prices.

Accordingly, a very ably written pamphlet, from Cupar in Fife, appeared on this subject, about the year 1812, and recommended the adjustment of land-rents, to be partly in money and partly in grain. This pamphlet attracted considerable attention at the time, and led some to adopt the principles suggested by it. Since then, very great interest has appeared amongst agriculturists on the subject. Some have proposed a rent made up of so much money, and so much grain *of one kind*. Others a rent composed of so much money, and a proportion of grain of *different* species. And a very favourite opinion now is, that a rent composed of a proportion of all the three kinds of grain most generally grown in Scotland, viz. wheat, barley, and oats, will hit the mark aimed at nearer than any other.

Of all the modes of fixing and appropriating grain-rents which have been established, we are decidedly inclined to give the preference to that adopted by the late Dr Coventry, Professor of Agriculture, and it is for the purpose of offering some details of this principle, which is the chief object of these few remarks.

In all valuations of the rent of land, whatever be the *permanent* footing upon which that rent is to be adjusted, it is of course necessary first to discover its worth per acre in money,

and the following is the method by which Dr Coventry proceeded in doing this: He first took the average productiveness per acre of the land to be valued *in oats*, because, after due reflection and observation, he considered that this article of produce, might fairly be taken as a just average of all the other kinds of produce usually cultivated on a farm in Scotland. Having settled its capabilities of productiveness in oats per acre, the Doctor converted it into a money-rent, by a process immediately to be shewn. The money-rent being found, the next step is to convert this into a proportional grain-rent, divided equally amongst the three species of wheat, barley, and oats, as appearing most equitable; and it is a fact worthy of remark in passing, that though at first sight, it may appear somewhat anomalous to put a proportion of wheat, for example, for rent in land, when little or none may be grown; yet experience of late years has shewn, that amidst the fluctuation of prices to which we are now so subject, the system of adopting a proportion of all the three kinds, will almost, in every case, prove most satisfactory both to landlord and tenant.

Let us now take an example in detail of Dr Coventry's mode of valuation and adjustment of rent. Suppose, that after taking into account all the circumstances of climate, soil, state of the land, and other particulars necessary to be had in view, the productiveness per acre is taken in oats at 6 bolls (of 6 bushels each), then, for ascertaining the proportion to be taken for rent, take the half and multiply by a tenth, thus,

The whole productiveness is . .	6 bolls,
The half is	3
Multiply by a tenth of 6 is . .	.6
Gives	1.8

Leaving then, as the proportion of productiveness to go for rent, 1 boll, and $\frac{8}{10}$ths of a boll, or nearly one third of the whole.

To convert this into a money-rent, the process is simple. The price assumed for a boll of six bushels is 18s., which is $\frac{9}{10}$ths of L.1 Sterling, following out the calculation decimally. We multiply then, the result already aimed at, or

1.8 of a boll of 6 bushels,
By .9 of L.1.

Gives L.1.62
20 to bring to shillings,

12.40
12 to bring to pence,

4.80
4 to bring to farthings,

3.20

Thus making the money-rent per acre, L.1 : 12 : 4$\frac{3}{4}$.

It now remains from these results to fix the grain-rent, in which it is usual, as already mentioned, to embrace a proportion of the three kinds of wheat, barley, and oats, reckoning 30s. as a fair average price for wheat per old boll of four bushels, (which measure, it is more convenient for our calculation at present to use, as shewing Dr Coventry's principle more plainly), 24s. for barley, and 18s. for oats, in all 72s. per triple boll.

So that, to discover the proportion of grain-rent, when that in money has once been ascertained, becomes just a question of rule of three. Suppose that 32s. is the money-rent per acre, we say if 72s. give 1 boll or 16 pecks of each of the three kinds of grain (which is 48 pecks in all), what will the money-rent of 32s. per acre give, thus,

72s. : 16 : : 32s.
16

192
32

72) 512 (7 pecks,
504

$\frac{8}{72}$

So that we have, from this result, for the grain-rent per acre seven pecks of wheat, seven pecks of barley, and seven pecks of oats, or twenty-one pecks of grain in all.

The prices here assumed, it will be observed, are 30s. per boll for wheat, 24s. for barley, and 18s. for oats, or 72s. for three bolls; but probably these may be considered by some as too high averages, as prices are at this particular moment, but taking a retrospect of years they will be found to be wonderfully near. It will be seen that 72s. is merely the medium price per triple boll, at which the rent is at first fixed, the fiars prices of the county being the regulator after that to a great extent. However, that the landlord may not unduly suffer in very plentiful years by the prices falling to a very low rate, 52s. was fixed by Dr Coventry as the price below which the range of rent could not go; and, on the other hand, that the tenant might not suffer by a scarcity causing prices to rise unnaturally high, and so expose him to be called on to pay for what he *had not*, 92s. was fixed upon as that price beyond which the rent could not be calculated. But of course these prices are liable to alteration from the change of circumstances in the county from time to time.

Although we are ready to admit that the principle above detailed applies more aptly to some districts than others, yet we think on the whole its application ought to be pretty general to lands in Scotland; and, with some change in the particulars, might be made to suit the circumstances of any agricultural district whatever.

There is one advantage of the system in question worthy of especial notice. It is this: Supposing the judgment of the valuator is at all correct in regard to the capabilities of productiveness which he ascribes to the land at first, the mode by which the quantity to be taken for rent is apportioned, will be found never to charge the land for more than it may fairly be conceived to bear.

In illustration of this, we refer to a table which we have prepared and subjoin, in which the letters B. F. P. L. at the top of columns 3 and 4, mean bolls, firlots, pecks and lippies, of the old Scotch corn measure.

1.	2.	3.	4.	5.
Supposed produce in Oats ℔ old Boll ℔ Scots Acre.	Proportion of produce for Rent in Decimals.	Part of productiveness for Rent in Oats.	Share of productiveness accruing to the Tenant for profit and expenses.	Rent per Acre in money reckoning Oats at 18s. ℔ Boll.
Bolls		B. F. P. L.	B. F. P. L.	L. s. d.
10	.5	5 0 0 0	5 0 0 0	4 10 0
9¾	.4875	4 3 0 0	5 0 0 0	4 5 6
9½	.475	4 2 0 1	4 3 3 3	4 1 3
9¼	.4625	4 1 0 2	4 3 3 2	3 17 1
9	.45	4 0 0 3	4 3 3 1	3 12 10
8¾	.4375	3 3 1 1	4 3 2 3	3 8 11
8½	.425	3 2 1 3	4 3 2 1	3 5 0
8¼	.4125	3 1 2 2	4 3 1 2	3 1 3
8	.4	3 0 3 1	4 3 0 3	2 17 6
7¾	.3875	3 0 0 0	4 3 0 0	2 14 0
7½	.375	2 3 1 0	4 2 3 0	2 10 8
7¼	.3625	2 2 2 0	4 2 2 0	2 7 3
7	.35	2 1 3 1	4 2 0 3	2 4 1
6¾	.3375	2 1 0 2	4 1 3 2	2 1 0
6½	.325	2 0 1 3	4 1 2 1	1 18 0
6¼	.3125	1 3 3 1	4 1 0 3	1 15 2
6	.3	1 3 0 3	4 0 3 1	1 12 4
5¾	.2875	1 2 2 2	4 0 1 2	1 9 9
5½	.275	1 2 0 1	3 3 3 3	1 7 3
5¼	.2625	1 1 2 0	3 3 2 0	1 4 9
5	.25	1 1 0 0	3 3 0 0	1 2 6
4¾	.2375	1 0 2 0	3 2 2 0	1 0 3
4½	.225	1 0 0 1	3 1 3 3	0 18 3
4¼	.2125	0 3 2 2	3 1 1 2	0 16 3
4	.2	0 3 0 3	3 0 3 1	0 14 3
3¾	.1875	0 2 3 1	3 0 0 3	0 12 8
3½	.175	0 2 1 3	2 3 2 1	0 11 0
3¼	.1625	0 2 0 2	2 2 3 2	0 9 6
3	.15	0 1 3 1	2 2 0 3	0 8 1
2¾	.1375	0 1 2 0	2 1 2 0	0 6 9
2½	.125	0 1 1 0	2 0 3 0	0 5 7
2¼	.1125	0 1 0 0	2 0 0 0	0 4 6
2	.1	0 0 3 1	1 3 0 3	0 3 7

This table, it will be observed, shews in the first column the supposed productiveness per Scots acre *in oats*; in the second column the proportion of produce in decimals to be reckoned as rent, which is found by dividing the respective numbers in column 1st by twenty; in the third column the proportion of actual productiveness in oats to be reckoned for rent, which is found by multiplying the respective numbers in columns 1st and 2d; in the fourth column the difference of the respective numbers in columns 1st and 3d, or the part of supposed produce left to the tenant after deducting the rent; and in the fifth column the supposed money-rent per acre, which is just the respective quantities in column 3d reckoned at 18s. for the boll.

ooking at this table, therefore, we see, that while land capable f producing ten bolls per acre brings out *one-half* for rent, land apable of producing two bolls per acre, only brings out one-enth for rent. Now, the principle upon which this proceeds is, hat the expense of labour and management of two boll-land is ust as much as that of labouring and managing ten boll-land, while the returns from the respective kinds are very different, nd therefore, it is quite fair, that if, in the poor land, the tenant as due allowance afforded to him for *the inferiority* of the land, he same consideration should be due to the landlord on ac-ount of *the superiority* of it.

It may be remarked, that if the principle in question is carried o an extent much beyond ten boll-land, too great a proportion vould soon accrue to the landlord for rent, but it will be found o hold good to an extent of productiveness fully equal to what re are ever accustomed to meet with in this country.

It may be mentioned that the produce of an imperial acre in olls divided by 16, or in bushels divided by 96, will give the ame proportion of the produce to be paid for rent as is obtained y dividing the bolls in a Scots acre by 20, so that column 2d f the above table may easily be made to shew the proportion f rent payable from the produce of an imperial acre. Thus, f the produce of an imperial acre be estimated at 8 bolls or 48 ushels, which is in the same ratio of productiveness as 10 bolls n a Scots acre, $\frac{8}{16}$ or $\frac{48}{96}$ is equal to .5 of a decimal, or one-half he produce for ten boll-land, as in the table, and so with the est.

DESCRIPTION OF THE POTATO-RAISER.

By Mr John Lawson junior, Elgin.

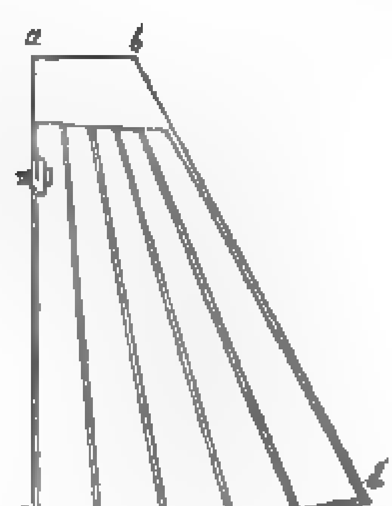
The potato has become an almost indispensable article of food, nd its cultivation is increasing every year. It, therefore, be-comes a matter of no small importance to devise a plan by which he expense of obtaining it may, in any degree, be diminished. With this view, I conceived the plan of a machine which, I be-ieved would accomplish the end I had in view, and which I now submit. Having stated it to the grieve on my farm, he

entered readily into the idea I had suggested, and, with the assistance of my blacksmith, carried it into effect.

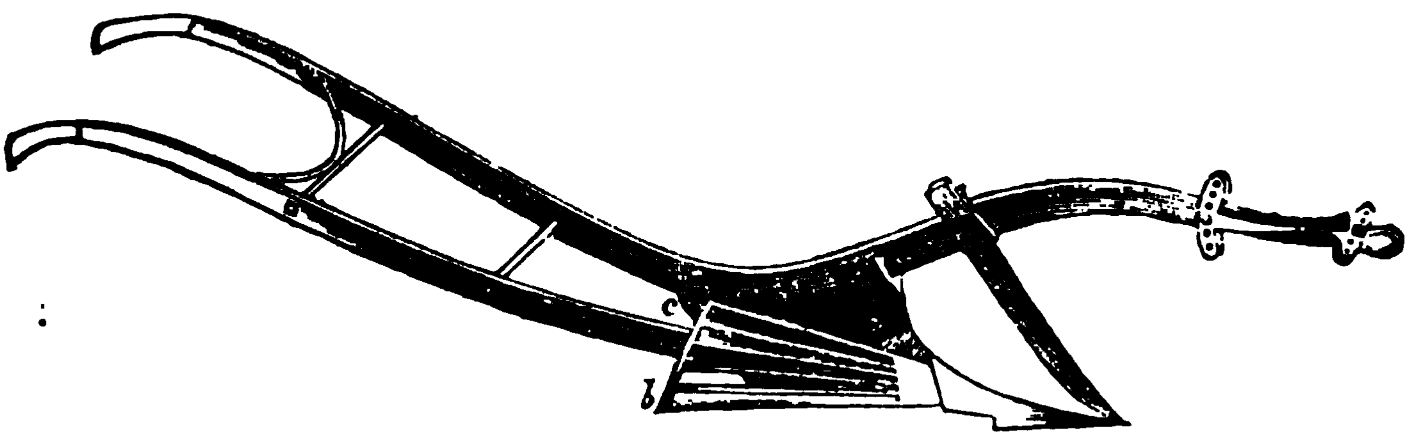
The present method of raising potatoes, is by the spade or the plough. The latter is generally adopted as being the less expensive. When potatoes are thus raised, those that are left in the ground after the action of the plough are brought to the surface by *hacks*, which incur a great deal of manual labour.

The machine I am about to describe, and which I would call the *potato-raiser*, besides doing its work more efficiently, a matter of great importance, saves all the *hacking*, and consequently all the expense of the manual labour which that operation incurs, for it throws the greater part of the potatoes on the surface of the ground, and at once enables the women employed for that purpose to gather them by hand into baskets.

The shortest description which, perhaps, can be given of this machine, is to say that you take a common plough, *deprived of its mould-board*, the share and coulter remaining in their usual position, and in room of the mould-board, attach an instrument similar to that which is represented in the cut in the margin, and which consists of malleable iron-bars, joined together in the form of a gridiron or brander. It is 26 inches long from *a* to *c*, 18 inches from *c* to *d*, and 27 inches along the line from *d* to *b*, and the breadth *a* to *b* 5 inches. It is attached by the edge *a c* to the furrow side and stilt of the common plough by screws, the fore part, *a b*, resting immediately behind the share, like the common mould-board, the angle at *c* is set about 8 inches above the sole of the plough, the edge *c d* slopes *downwards* in a convex curved form until the point *d* is about 4 inches above the level of the sole. The brander is fixed by screws at *c f*, and one may be required at the solid part *a b*, but these fixtures must be regulated by the construction of the plough. The following cut represents a plough mounted as a potato-raiser in the manner here described. The brander can be taken off the plough at pleasure, and the mould-



board again attached, by which the plough can be again ap-applied to its own proper use. One advantage of applying it to a plough, is, that the whole apparatus may be had for ten shillings.* It may be mentioned, that it is a matter of very considerable importance, to attend to the gradual slope which



the brander ought to have *from* the landward edge. Were it to lean *inwards*, or towards the land-side of the plough, it would do its work but imperfectly.

The potato-raiser is drawn by one pair of horses, in the same manner as a common plough. In working it, the ploughman inserts the machine into the potato-drill, so as to have the whole of the potatoes on the *right-hand side* of the machine. He then proceeds along the drill, splitting it up in the common way. The earth is thus thrown to the right hand side, and the potatoes lie scattered on the surface of the ground behind the plough.

Women provided with baskets follow the machine. They gather the potatoes into the baskets, and throw the stems of the potatoes upon the drill which lies to the right-hand of the drill from which they are gathering the potatoes. The reason why the potato stems are thus removed, is, that, as soon as the potatoes which lie on the surface are gathered, the machine returns, and again proceeds as before, through the part of the drill in which the potatoes lay, still turning the earth to the right-hand side. This *second* operation raises to the surface any stray potatoes which the first may not have turned up, and the potatoes raised by the second operation, are immediately gathered by the women who attend for that purpose. This second operation may be delayed till about twelve drills are turned over by the first operation, and the potatoes gathered. The machine

* For the sake of those who desire to fit up ploughs in this manner, it is desirable that the strength of the iron of the brander had been particularized. We conceive the external frame should be five-eighths of an inch square, and the internal bars one half inch diameter.—EDITOR.

may then be put through these twelve drills the second time. By this there will be a saving of labour, as a smaller number of women will gather the potatoes raised by the second operation. If the stems of the potatoes be very *strong and luxuriant*, a few women may be put along the drill to pull them out of the ground, at the same time gathering up any potatoes that may adhere to, and come along with, the stems. If this be done, the potato-raiser will turn up the greater part of the potatoes by going *once only* through the drill; in going *twice* it will do it in the most satisfactory manner. A man with one pair of horses will thus pass over the ground as quickly as with a common plough.

These two operations are all that are required to raise the potatoes to the surface, the land being afterwards harrowed in the common way. The potato-drills ought to be of the ordinary breadth, so as to give the machine room to work. Very narrow drills do not suit it.

I may mention, that the farm on which the potato-raiser has been used, is a light loam, and in that soil it performs its work in a very satisfactory manner. It pulverizes the soil in an extraordinary degree, and scarcely leaves a potato in the soil. I have never before been able to clear my fields of potatoes so effectually as by this machine, or at nearly so small an expense.

THE AGRICULTURIST'S NOTE-BOOK,—NO. II.

I. *Embanking the Basin of Montrose.*—In opening our note-book for December with some remarks on embanking, we had no intention of attempting a history or detailed account of what had, within the last ten years, been done in this way in Scotland, or the methods pursued, or profits obtained by those who had been engaged in it, as this was more likely to have filled a volume than to have furnished matter for the opening fragment of an article. Striking as were the facts which we had taken some labour to collect, and to check the accuracy of which no pains had been spared, we were not aware that they would seem *so* striking or *so* novel to the public as their almost uni-

versal circulation over Britain, through the newspaper press, would now lead us to believe them to have been. Assuming this as the criterion of the interest felt, we trust that we shall not weary our readers of the subject, if we follow up our former statements with some remarks on reclaiming an extensive tract of valuable land, in one of the most favourable localities for embanking which the estuaries on the Scottish shores present us with. Our former allusions to the basin of Montrose occasioned considerable speculation, we are informed, in the east of Forfarshire, and certainly called forth some very sensible and clearly put together observations in the local newspapers. Without having ourselves made an actual survey of the basin, from facts in our possession and documents before us, we think that we shall be enabled to make some suggestions which may lead to a survey which, if it be suitably made, and estimates be drawn up with sufficient caution therefrom, will, we have no doubt, speedily lead to a very striking enhancement of the territorial value of that very beautiful and rich portion of the country. Taking Mr Leslie's engraven plan of the basin for our guide, we find that beginning our embankment near the fish-house, some 600 yards below the Bridge of Dun, and carrying it along by the line of low water mark, as near the channel of the Esk as may be found expedient, down to the junction of the Taik, and thence proceed northward to Taik Bridge, by the side of the burn which we ultimately keep outside of our embankment, we shall enclose a space presently covered by the tide of 1445 acres or thereby. This excludes a very large space betwixt our southern embankment and the Rossie shore, as well as another similar one betwixt the channel of the Taik and the sea water-line of beach. These might be reclaimed after the first great operation was shewn to be productive, from which we have excluded all dubious and difficult ground. The total length of the embankment required for this would be somewhat under three miles and three quarters, or 6700 yards nearly. Assuming that the rise of the tide here is similar to that in the Tay at Newburgh, and that it will require a similar strength of dyke to resist the waves, an embankment precisely similar to that carried for some miles along the shores of Pitfour, Errol and Seaside, will suit our purpose. In point of fact, the force

of the waves, as well as of the current, will be infinitely less in the Esk than in the Tay. In the latter case, when the wind blows from the mouth of the river, they break on the banks with a sweep of twenty miles; the roll even from the Fife shore is nearly 2000 yards,—the tidal current rushing along to fill up the channel of the river ten miles long to the Bridge of Perth. On the other hand, were the tidal current to be confined to the channel of the Esk, its destructive power would be very inconsiderable, while the sweep of the waves from the chain bridge to the highest point where they could affect the embankment would be less than 3000 yards, and right across from the Rossie shore would only be 600 yards. We may safely conclude, then, that the Carse of Gowrie's embankment would be more than adequate to meet all our exigencies both in strength and magnitude. This saves the difficulty of a speculative estimate, which in general falls much short of the ultimate outlay, and gives us a piece of work which has already been executed when embanking was comparatively new and little understood, to compute the price by one now to be undertaken with the benefit of former experience. The average cost of the embankment on the Tay, of which the stones of the front portion are brought from Fife with a sea-carriage of about one and a-half miles, and a previous land-cartage of about three quarters of a mile, is, including sluices and allowing for accidents and contingents, L.1 per yard. An embankment constructed on the Eden, near St Andrew's where the sea is very heavy, cost, a few years since, L.1250. It is ten feet high and thirty broad at base. It is built to the height of seven feet with carefully dressed stones brought from a distance, and is fitted up with fine brass valve-sluices fitted to cast-iron tunnels. These, together with an enormous breach, which was made in it by a sea-storm while it was unfinished, will account for its expense which otherwise would have fallen under that of the Carse of Gowrie dykes. We could thus enclose 1445 acres of invaluable land for L.7000—for less than L.5 an acre! Two objections may here be offered by the overcautious: 1st, It was tried before, as the remnants of the Droners' (Drainers'?) Dyke indicate; 2d, If these enormous advantages are held out, Why have they not already long ere now been taken advantage of?

two may be met with one answer,—That it is only twelve ; since the first successful and profitable embankment of extent was constructed in Scotland, and the art begins only to be understood. But for the energy and skill of Mr Ro- Walker Rannie, of Pitfour Mains, land at this moment ing a rental of above L.2000 a-year might have been, as s in the year 1826, still under the waters of the Tay ; yet the total recovery of this and the incipient reclaiming of r times as much more, proprietors whose shores are well ted for embanking, look on with suspicion and distrust.

will be said that the present soil in the basin of Montrose orthless ; it may be so,—so is the soil in the Tay till embanker begins his operations. He creates, or at least cts, the soil suspended in impalpable flocculi, and ready to arried far out into the German Ocean, till his operations t them.

he following plan of operations might be adopted at Mon- . A fitting line of embankment being traced out, the ma- l for its construction might be found partly in the sludge h the basin already contains, partly from the excavations he new wet-dock, or the mud taken up by the dredging nine which might be floated up in barges with the ascend- tide, but chiefly by earth procured from the shores in the ction of the Bridge of Dun, towards which a large canal ld require to be made to admit the waters of the Esk, the purpose of *warping* after those of the ocean had excluded. At first the Taik need not be shut out. The dyke to be constructed should be brought right across its th, and parallel to the Esk or to the shore. The embank- t along the Taik parallel to the town is 2000 yards long, would not be necessary till a sufficiency of silt were col- d, say six years afterwards. It might then most likely be tructed at a third less expense, from the quantities of loose erial we should by this time have at hand. We should save interest and outlay together to the extent of L.1200. should have to meet this, however, the construction of 300 ls of embankment, which might turn out of very little use, cost L.300 dead sunk. The embankment being entirely com- ed, and very large sluices fitted up at the top near the Bridge

of Dun opening to a canal, so as to admit the whole of the Esk at pleasure, or any part of it which might be deemed requisite; and about 100 yards of the embankment next the town should be left about eighteen inches lower than the rest; in fact, only some six inches higher than spring-tides. This should be made so compact that a rush of water flowing over it should not injure the dyke. The tunnels for ultimate drainage, by means of valve-sluices, should be made much more numerous than they generally are, and fitted up at the inner extremities with a very wide floating limb, like the apparatus used "for draining ponds without disturbing the mud." The Taik being already dammed up, we might now admit the Esk. These would fill the whole enclosure with an expanse of water so still, that every particle of mud which remained suspended by it, while in motion, would be speedily deposited. A portion of this would make its escape especially when the tide was out, through the apparatus just described as appended to the tunnel. This drawing off solely from the surface would carry away only what was bright and transparent, and from which the whole earthy matter would have been precipitated. Whatever these might be unable to draw off would flow over the low portion of the embankment, without producing any current save a slight and imperceptible one at the surface, or disturbing the stillness of the stagnation. From time to time the Esk should be wholly shut out, when least charged with mud, and now the chief uses of our tunnels would appear. The whole waters of the gigantic dam should be allowed to drain off through these, which they would readily do without carrying with them any of the silt desired to be detained. The ordinary flow of the Taik would also be carried off by them with the same conditions. We should not only thus, from time to time, see how matters proceeded, but should give the mud already collected the opportunity of a few days' or weeks' exposure to the sun of becoming compacted, after which it is found to be at no future period liable to easy disturbance or removal.

In Perthshire, where want of material prevents them from constructing embankments till after a great quantity of silt is collected, they cultivate reeds to assist in its enlargement. By this means they are enabled permanently to detain from four

to nine inches annually, great loss being sustained from the quantity always carried away by freshes in the river. The planting of the reeds, which never requires to be repeated, costs about L.12 per acre, and after the first year the crop is worth from L.3 to L.5 annually. In the Forth, a large portion of the mud is collected after the embankment is begun. The water is too salt for reeds, and the mud accumulates here at the rate of from eight to ten inches annually. At the mouth of the Ouse and the Humber, where the operations of warping have been so long and so successfully carried on, water let in from time to time on lands already enclosed will deposite from 1½ to 3 feet annually. It does not appear that at Montrose reeds would be required, and if so, however, though they are ultimately troublesome to eradicate, they themselves will be found at once a profitable crop. Suppose that only six inches of mud are annually accumulated, and this is less than we have found in any of the cases we have spoken of, though these be much less favourably situated, in five years we shall have three feet of soil, to which the fertility of the richest in Forfarshire would be as nothing, and on which a tenant paying L.5 an acre would probably in the course of a single lease make his fortune. Let us see how our account as to outlay and returns will now stand.

Embanking the Basin of Montrose. Recoverable Surface fit for Cultivation 1445 *Acres.*

1840.				
	To paid for the construction and finishing 6600 linear yards of embankment, at L.1, . . .	L.6600	0	0
	— — interest on do. till 1846, when lands are full cropped, ...	1980	0	0
1846.				
	To embanking 2000 yards to exclude Taik burn, .	2000	0	0
	— wages of three workmen to look after banks, &c.	470	0	0
	— superintendent's salary for do. at L.50 per annum,	300	0	0
	— contingencies at 5 per cent. on expenditure, .	568	0	0
	Total Gross Expenditure	L.11,938	0	0
	Annual rent of 1445 acres of land at L.5 per acre, L.7225, equal, at 20 years' purchase, a capital of	L.144,500	0	0
	Deduct expenditure, ...	11,938	0	0
	Balance in favour of speculation, . . .	L.132,562	0	0

Surely this is a return which might satisfy the most avaricious, a security on which the most timid might advance capital. Should it, from the very splendour of its promises, be viewed as chimerical, as doubtless it will be, let any one examine the reasoning, the facts, and computations, for themselves, or apply to the present writer for his authorities and sources of information, and no dread is felt but that the whole speculation will be found to remain unimpeachable, ready to be acted on by the first man of talent and enterprize sufficient to apprehend its advantages.

Though this may seem a rich golden harvest, there are yet gleanings behind far more abundant than the total produce of nine-tenths of the speculations which in the present day are received as remunerative. The present western access to Montrose from Brechin and Strathmore is as awkward, circuitous, and angular, as can be supposed. Let a new road be taken off at Arrot, and brought in a perfectly straight line through the now reclaimed basin right into town at the market-cross, and you have one of the ugliest exchanged for one of the most magnificent approaches in Britain. We hold it as nothing that by this, two miles of uneven and ill-to-be-kept turnpike road would be saved, though, in an economic point of view, that is not to be jested with ; but think of the enormous increase of the value of property—think of the magnificent three miles long vista of poplars, which would rush up like magic in such a soil, till more massy and more permanent timber-trees were ready to take their place—think of this passing through fields of unsurpassable fertility and beauty, the gorgeous landscape all around, stretching away under a summer sunset's glow by the hoary history-associated towers of Brechin, over or through Strathmore till the dark blue masses of gigantic Catlaw closed up the scene ! Would not this be a change worthy of the science of the nineteenth century to contemplate, and of its art to achieve ? After this the natural deepening of the river and improvement of the tide, so that two feet more water might be obtained at Old Montrose, and vessels of fifty tons weight 'liver at the Bridge of Dun, become so insignificant, and though demonstrable that fancy spurns them as worthless and vulgar things

Enamelled Hardware.—This admirable substance is of German invention, and has only of late years been introduced into the southern part of this country, where it is still but partially known. The art of enamelling on iron, *it is said*, cannot be accomplished by our manufacturers; and we are in a degree disposed to give credence to the assertion; for we know two instances in which potters have given their opinions of the impracticability of its accomplishment. During a visit to London three or four years since, our attention was attracted by some iron sauce pans and frying pans as we passed the shop of an ironmonger at the corner of the Old Bailey, on Ludgate Hill, which appeared as if they were lined with white paper, instead of being tinned in the usual way. On investigation, we found them to be enamelled; and, by inquiry, learnt the following particulars:—That they are imported, a ship-load at a time, from Germany; that the manufacture is unknown in England; that they are durable, and not liable to injure.

We immediately purchased one; and, subsequently, several others of different sizes, as well as a frying pan, and are *entirely satisfied with them all.* We will enumerate their advantages, and our readers will thus judge for themselves, whether or not our panegyric is too highly coloured, when we pronounce them to be the *ne plus ultra* of cooking utensils,—without a fault! They are kept clean with the least possible trouble; they never crack or craze, and they perfectly retain the colour and the flavour of every product of the culinary art;—so many sad accidents have resulted, and are still occurring, from the use of copper sauce-pans, stew-pans, &c., that it becomes a duty, with every writer of influence, to dissuade the public from the use of them, by urging the deleterious nature of copper on their attention. To our readers, we are well aware, this information will be superfluous; but they must know, as well as ourselves, that errors remain unrectified,—abuses exist unabated—faults rest unreproved—dangers lurk and threaten uncared for, until our natural supineness is roused by an actual evil overtaking us, which might and ought to have been prevented from existing. When too late to avert a calamity, we wonder at our apathy, and bewail our culpable remissness. Gentlemen are out of the sphere of copper stew-pans, and provided they find their din-

ners well appointed, care nought for the kind of metal in which they are cooked; domestic matters being very properly consigned to the lady of the establishment. But it unfortunately happens, that ladies dislike to interfere, and rely upon the sagacity of their housekeepers, who also depend upon the cleanliness of their subordinate kitchen-maids; and thus may the lives of a whole household be periled by the ignorance or idleness of this denizen of the scullery, as yet unvisited by "divine philosophy." We can well imagine, that on reaching this period of our subject, some "lord of a wide domain" looking off from his "Quarterly Journal," will address his lady with this startling question, "Are there any copper stew-pans or sauce-pans in the kitchens my love? To which she will, with unfeigned surprise, reply, "Really my dear, I do not know, but I dare say Harris can inform you;" and the affair of poison in a ragôut being momentous, the housekeeper would be summoned, and be in turn astonished with a similar query. Her reply of "Yes, at least a dozen," would complete the incipient dismay; and an order to have the dangerous utensils abolished, with the reason assigned, would infallibly elicit a decided assurance on the part of the confidential servant, that "all stews *must* be made in copper, for iron, tinned, would impart a flavour; that preserves and pickles *must* be boiled in copper, because they would lose all colour, and not to be fit to be placed on table, if iron was to be substituted."

This imperative "*must*" would, alas! in too many cases, decide the matter, and that vile pernicious copper still bear sway in the kitchens. In these admirable German stew-pans, however, we have a succedaneum of unquestionable capabilities, to supersede the necessity of pleasing our eye at the risk of our lives. Every species of cooking has been performed in our own utensils for several years, and to far greater perfection than we ever experienced, previously to the introduction of the enamelled hardware. Independently of its salubrity, we should give it the preference over every other; for, in consequence of the delicate and innocent nature of the glaze, which resembles that of china, all colour and flavour are preserved in their utmost purity; and all housewives are aware that these are desiderata in pickling and preserving.

We have stated that this ware is not liable to injure; but we

ought to have placed this essential advantage in much more forcible language. The union of the enamel with the iron is so intimate, they are so entirely amalgamated, that it is utterly impossible to effect a separation; and we have known, that in the attempt several iron tools have been broken.

If we knew of a fault in them we would gladly name it, not only as a guide to ourselves in our future purchases, but because our readers would, perhaps, trust rather to qualified than unqualified praise. The only drawback which we ever found, was in their weight, which was greater than those made in England of the same size, and perhaps a dissightliness in the forms compared with those of our own manufacture; but both of these trifling objections have recently been removed. We confess that we had misgivings when we made up our mind to order a frying-pan, that the enamel would not endure the very great heat to which that kind of cooking necessarily subjects the vehicle in which it is performed; but we are gratified in being able to assert that we have had one in frequent use for some months past, and it is as white and uninjured as when we received it first.

We should rejoice to hear that our own manufacturers intend to give their attention to this useful and beautiful art, and what can they not achieve with that industry, perseverance, science, wealth, and emulation, for which they are, above those of all other nations, celebrated?

Is the Action of Lime on Land elucidated by Macaire's Theory of Vegetation? By Mr William Browne, Tallantire Hall, Cockermouth.—The late Dr Anderson, who appears to have united, in no common degree, the chemical knowledge of his day with a practical knowledge of agriculture, seems in his essays to think, that lime cannot be applied to land in too large quantities. But though his opinions of its beneficial effects are so decided, it does not appear that his notions were very clear as to its mode of operation.

Sir H. Davy, in his Agricultural Chemistry, from which at the time of its publication so much was expected, and from which (probably owing to his having little *practical* knowledge of agriculture himself) so little advantage has been derived,

has written a good deal both upon lime and its action on the soil. His conclusions are perhaps not always very clear, nor perhaps in all cases quite in accordance with each other. Whatever difference of opinion, however, may exist upon this point, none, I believe, exists among practical men, that there are many anomalous circumstances attending the application of lime in practice, which are yet unaccounted for and unexplained.

It has long been found that all plants flourish more vigorously when not repeated too frequently on the same spot. But the true cause of this, though of very great importance in practical agriculture, appears to have been unknown, and, till lately, quite unsuspected. The crops most in demand will always induce the farmer to a frequent repetition. Should the theory of Macaire prove, as I make no doubt of, correct, it must ultimately tend to effect a decided change in our rotations, as so often carried on, in inferior districts especially, where we find a succession of corn crops, for instance, far too constantly repeated.

However strong the practical results were in favour of the theory of Macaire, the cause assigned by the farmer for the increasing deterioration of his succeeding crops was an erroneous one. We have been accustomed, not unfrequently, to hear of land being "worn out," "tired," "exhausted;" that it required (like the labourer who tilled it) rest, as well as renovation. In such cases, a stimulus of lime was applied where it could be obtained, which, though known not to be manure, appeared to act as such for a time in some way or other, to the lands in question, by more or less renewing for a short time their fertility, though no one could assign a very competent reason why or wherefore.

Living in a limestone district, and where the management is only very indifferent, I have been often struck by the renovating powers which lime, when applied to such "exhausted" lands, appeared to possess; especially to lands (a very common occurrence in this vicinity) exhausted as it were by a long and frequent repetition of oat crops, and which lands had received for years no other manure than a miserable pittance of strawy litter. It is true that the effects of lime in such cases appeared

to be less than formerly, still that the effects were considerable was evidenced by the fact, that though manure (dung) might be applied in tolerable fair quantity, yet its effects seemed to be less efficacious until the application of lime preceded it.

Now, I would venture to suggest, whether the operation of this calcareous stimulant may not in similar cases be accounted for and explained upon the theory of Macaire?

If, as he advances, and which seems now pretty generally admitted, plants, while growing, not only derive nourishment by their roots from the soil, but also, at the same time, exude from their roots a feculent excrementitious matter, which affords no nourishment to, but on the contrary is decidedly pernicious to plants of the same sort, though probably in many cases nutritive to others of a different species, may we not from analogy conclude, that the action of lime, when applied to the soil under such circumstances, *i. e.* when filled with this feculent exudation, tends by some means to neutralize its acrimony, and not only to render its noxious qualities inert, but probably to promote that decomposition of this excrementitious exudation, which may either render it soluble or prepare it again for nutriment, even to those very plants from which it had been thrown out, and to which in its then state it seems poisonous?

I confess I see no other way by which some of the remarkable effects of lime, when applied to lands, in many cases, with which every practical farmer must be familiar, can be more rationally explained; and it appears to open, not only a new view of the action of lime, and how and when it may often be applied with advantage, but we conceive it tends to throw some light also upon the advantages of fallowing, a subject which, like the action of lime, has been hitherto, though much wrote upon, very imperfectly explained.

To the practical chemist there could be no difficulty in making experiments to ascertain the fact, as well as some important results which may arise from it, in precisely the same way as has been done to verify Macaire's theory. The practical farmer, too, may find ready opportunities of putting it to the test, though with less precision as to the results, inasmuch as he will be subject to much greater interferences and disturbing causes than the chemist. The results of such an inquiry, well

conducted, and followed out to their fullest extent, may tend, we conceive, to explain the action of lime in one of its most difficult modes, as well as the *state* in which it should be applied, and the best time of applying it.

It may, perhaps, be asked, how, and in what manner, we suppose the lime to act chemically upon this excrementitious matter, so as to render what is noxious favourable to vegetation? As nothing is more agreeable than the construction of a theory, so few things are generally more easy to a speculative mind; and assisted by the discoveries of Einhoff and others on the vegetable process, a supposition might be advanced, we conceive, supported by very plausible arguments. Until, however, the exudation in question has been analyzed, and its real nature clearly ascertained, it would be idle to theorize how lime acts upon it, and whether in its caustic or effete state. Till then, such theories could only be vague, and might ultimately mislead.

The great questions at present to be ascertained, in order to a *scientific* solution of the subject, are—the nature of this exudation from the roots of growing vegetables,—and in what the difference consists, which renders the exudation of one plant nutritive to another species, while it is poisonous to that from which it originated? Are all these exudations in any, and in *what* respect similar? Is it an acid? If so, of what sort? Can it be of the nature of peat? Lastly, what new chemical compounds does it form with lime,—are they soluble or insoluble,—active or inert to vegetation?

Having invited the attention of my scientific readers to this subject, I will not venture (at present at least) to go farther. Hoping that some of your correspondents, more capable than I profess to be, will be induced to take it up, and give that attention to it which it seems to merit, and by which we feel persuaded a very valuable service may be rendered by chemistry to agriculture, more especially to the owners and occupiers of lands, now far too common, exhausted, as it is termed, by a too frequent repetition of corn crops, and which it is often, from their locality and other circumstances, very difficult to know how best to deal with, from the apprehension of farther exhaustion from a heavy dose of lime, which, if our suppositi-

tion proves correct, is not only the best, as it is generally the readiest, remedy, but also the most necessary one to commence with, in order to free the soil from that superabundance of this excrementitious matter with which former crops have saturated it.

The Suburban Gardener, and Villa Companion, comprising the choice of a suburban or villa residence, or of a situation on which to form one. By J. C. Loudon, F.S.S., H.S., London, Longman and Co.

This valuable work has reached its 8th number, and when finished, is likely to form the most complete one on villa gardening, that has hitherto appeared in our language. Its indefatigable author seems quite at home when treating of such matters as are indicated by the title, and possesses ample materials, and sufficient skill and experience, to enable him to make it the most interesting of its kind. In the limited space which frequently surrounds the Suburban Villa, it is often more difficult to produce a strictly tasteful effect than in the more extended lawn or park, and hence too many incongruous patch-works may be seen about villas in the neighbourhood of large towns. Even the squares in our Scottish metropolis (with reverence be it spoken) offer tempting subjects for criticism, and, in truth, exhibit unsightly specimens of uncultivated taste; if the term taste can indeed be perverted in speaking of such unmeaning abortions. The Prince's and Queen's Streets gardens are more pleasing objects. But we have not space at present even to broach the fascinating topic of landscape gardening. We shall only offer a few extracts from the succinct pen of the author, on the "*Leading rules for laying out and planting flower-beds in the front gardens of street-houses*," which we think may be perused with interest by our suburban readers, and at the same time afford a specimen of the work.

"Rule 1. When the space is small and surrounded by trees and high walls, so as not to be open and airy, it is not desirable to form beds or borders round the margin of the plot, but rather to have only one bed in the centre and the rest in grass. 2. Where the space is open and airy, either large or small beds may be formed, and it will generally be desirable to surround the whole plot with a narrow border. If the ground-floor of the house is two feet or

three feet above the level of the plot, then a figure or collection of beds may be laid out, which shall be looked down upon from the window as a whole, and consequently, to aid this purpose, the beds ought to be planted with low-growing plants, and, in general, to have the surface covered by them, each bed in this case being of only one kind of plants. 3. Where the rooms on the ground-floor are on a level with the surface of the front garden, or nearly so, large plants may be employed in the beds, provided the beds also are large; because, as in this case, the beds cannot be looked down upon, and consequently their plan can never be taken in at one glance, it never can be seen as a whole from above, it is better, therefore, to use large plants which, by growing of such a height as to form a whole or group when looked at laterly will prevent the idea of a whole formed by the shapes and lines of the bed, when seen from above, having been intended by the planters. 4. In general, no figure or assemblage of beds, of any degree of intricacy, and when the beauty is dependent on the shapes of the beds and their connection together, should be formed where they cannot be looked down on, so as to be seen all at once. In general also, parterres or assemblages of figures of this kind, should only be planted with very low plants, which will not obstruct any part of the outline of the figures, with the exception, however, of an occasional tall plant such as a standard rose, to produce effect by contrast. It may be further observed, that, when plants are to remain permanently, such should be chosen as continue in flower for a long period (say two or three months) in preference to such as complete their time of flowering in a short period, say two or three weeks. On the other hand, when flower-beds are furnished with plants in pots plunged in the soil with a view to changing them and replacing them by others, as soon as they have done flowering, plants which remain in flower a short time should be chosen, because these have, in general, a greater number of blooms expanded at the same time, and consequently, while they last, have a more brilliant effect. This is particularly exemplified in the case of bulbous flowers and in certain annuals such as Candytuft, ten-week stock, &c. 5. Where a symmetrical figure is employed, beds which answer to each other in form and position ought to be filled with plants either of the same kind or of the same general appearance, and which flower at the same time; for example, a bed of mixed hyacinths can only be properly opposed to another bed of mixed hyacinths; but the mixture need not be the same on both beds. A bed of the small dwarf blue Lobilia may be opposed to a bed of the blue Anagolis, &c. 6. Where it is desirable not to have more than one plant of a species in a symmetrical figure consisting of various beds, the principle of symmetry may be preserved in planting, by placing each colour by itself. Thus a bed of white flowers consisting of ten plants of as many different species may be opposed to another bed of ten other different species also with white flowers. 7. The dry surface of beds formed on a grass plot, ought either to be decidedly under the surface of the grass, or decidedly above its level, in order to increase the expression of art, and to take away from the common-place idea of merely digging down a portion of the turf of a particular shape and planting it with flowers." "The 8th and 9th Rules are illustrated by engravings

shewing various modes of forming edgings of flower-beds with brick or tile, elevated above or depressed below the surface: for these figures we must refer to the work itself and proceed to Rule 10th. "Borders of brick or stone or other architectural materials ought to be narrower than borders of turf, lest the force of contrast should be too great for the general effect. 11. Where borders of box or other plants are employed to form margins to flower-beds on turf, they ought to be of several times the breadth which they are when employed to separate walks from gravel, in order to give them a distinctive character, and to produce sufficient force of effect to justify their use. Nothing looks worse than a narrow edging of box surrounding a bed on turf, the narrow edge of box appearing in that situation to be quite superfluous, and its colour not contrasting with that of the grass, it has a dead dull appearance. 12. Where beds are surrounded by gravel walks and edged with box, the latter ought always to be of such a breadth as to form a strongly marked line, and though the sides of the edging may be clipped so as to give them a slope and prevent their getting naked close to the surface of the ground, yet the top should always be cut quite flat and level. 13. Nothing looks worse in a flower-garden than to have the box-edgings narrow and high, except having edgings of turf margins so pared by the spade as to shew the raw naked earth." (p. 213-215.)]

There is much judicious originality in this work, a work the perusal of which would prove the means of soon improving the appearance of the villa gardens in Britain.

Artificial Feeding and Dressing of Breeding Sheep for sale.—To reproach a custom which time has sanctioned as right, indicates either great stupidity, or a certain conviction that the practice is wrong; but the inutility, and even knavery, of over-feeding and dressing breeding stock, especially tups, is so unwarrantable, that I cannot help hazarding a few thoughts on the subject. It is unwarrantable, because dangerous to the animals themselves, inasmuch as it urges the constitution to a state of indirect debility. No sooner do tups pass into a state above their medium habit by over-feeding, than they are as much incapacitated for exercising the healthy functions of life, or readily propagating their kind, as when through carelessness or ill usage they sink below the medium state. With a great increase of fat, animation is diminished, the spirits are enfeebled, and the generative powers benumbed; for when their condition approaches to obesity, they may be fit for the butcher, but quite as unfit to propagate their kind as when debilitated by poverty or disabled by disease.

Of all our domesticated animals, sheep in a wild state are the most fastidious and nice in their tastes, yet, when tamed or half domesticated, no creatures lose their original relish so completely. Of every preparation from grain they freely eat, and even of a liquor in which their own species has been boiled they will swallow to excess, or of a broth into which animal juices have been infused they will greedily feed. When thus luxuriantly fed, it is no wonder they attain to great weight and size.

I do not mean to assert that there is positively a certain and fixed point of goodness to which the animals must alone attain, in order to secure their thriving condition and productive powers. There is no doubt a certain period of life, and to every sheep a certain flow of spirits and vigour, at which life is briskest, and all the vital functions proceed with the greatest ease, but a few degrees above or below this state do not sensibly impair the functions of life, or incapacitate animals for future productiveness; and it is fortunate that it is so, for what with injudicious management and improper feeding, what with unpropitious seasons, or even untoward courses of weather, which in no lengthened period of time injure the feeding properties of herbage, the creatures which are exposed to all these vicissitudes may not gain that fortunate point of health and strength for some seasons.

It is the person who purchases over-fed stock for breeding who is the only loser. When stock of this description is offered and sold to the butcher, he can be as certain of its value as he who has solved a problem in mathematics is sure that it is rightly solved. The person who buys stock for breeding is no doubt aware, that fraudulent arts are used to give sheep a shewy and sale-like appearance, but he may not know, at least cannot be certain, that they have been practised upon the animals he is bargaining for. He thus purchases in uncertainty, perhaps he must buy at all events; but one may as well expect that the progeny of sheep so artificially dressed, as they are in too many cases, will come into the world with similar private marks imprest upon their parents to testify their owners, as that they will exhibit in their figures the same proportion of parts, or the same embellishments on the head, legs, and tail, executed by cunning art and fraudulent intention. The fraud consists in

naking coarse sheep assume for the occasion the external characters of fine.

In sheep intended either for sale or show, it is both allowable and commendable to clear away impurities from their coats, or any appendage or pollution they may have contracted from the pasture; but to suffuse a fictitious colour over the wool, that the wearer may appear healthy and hardy, when it is perhaps neither; to clip the wool with that dexterity and cunning that imperfections in the animal's shape are suppressed, and those essential points to which a breeder principally attends, are exhibited so as to appear supereminent, thereby raising the expectations of the buyer, that if he put suitable mates to them, these excellences would be transmitted to their progeny, such deception is certainly an outrage upon the judgment of the confiding purchaser or hirer, who, if he did detect the deception at the moment, and expressed his conviction of its existence, could not legally prove its practice in the particular case, and thereby render himself amenable to the laws of his country. Whilst the duped purchaser, who is the only loser in such a transaction, is unprotected, the deceiver may appeal to the laws against what he would, no doubt, term defamation. The practice is abhorrent to honesty and fair dealing, and ought to be abandoned. Only think of the consequences of employing tups whose pedigree and from what stock they have been selected are unknown. Disease may thus be propagated by them into an hitherto healthy stock, and, at any rate, creatures artificially fed and dressed can never be proper animals to breed from, where the stock is destined for a mountain range. No one can ascertain how many bloods may centre in a single individual thus employed, whose origin is concealed and admitted to a stock of pure blood. What confusion and dissimilarity may not such a cross engender in coat, countenance, figure, and animation; and if the pure race is to be retained, the whole stock thus contaminated must be purified from the heterogenous blood, which purification may take several years, and, after all, leave a tincture of the foreign connection, nay, perpetuate a sickly, unsuitable, dissimilar breed for the situation they were intended. Using purer and fresher blood can never do harm, although the points of the progenitors may be dissimilar, for in such a case similarity will

be engendered and confirmed by the better blood; but the using of inferior blood and points entails incalculable mischief, and it is chiefly on the inferior animals that the fraudulent acts of over-feeding and dressing are practised by men pretending to high character.

ORDNANCE MEMOIR.*—COUNTY OF LONDONDERRY.

THE first complete volume of the Topography and Statistics of the city and part of the county of Londonderry, has been recently published by the Ordnance Department in Ireland, under the superintendence of Colonel Colby, of the Royal Engineers. This book, sold at a very inconsiderable price, is a noble specimen of what may be expected from the scientific labours of very able and accomplished men; and such have obviously been engaged in the work. The quantity of important and interesting matter furnished is very considerable, and the style and arrangement are admirable.

The portion which comprises natural history and productive economy, drawn up by Captain Portlock, is written and arranged in a very masterly manner, and peculiarly suited to our pages; the antiquarian will find delight and information from the labours of Mr Petrie; and to Mr Laicom, of the Engineer department, who, according to Colonel Colby's preliminary statement, conceived the idea, "that with such opportunities, a small additional cost would enable him, without retarding the execution of the maps, to draw together a work, embracing every species of information relating to Ireland," whose capabilities and resources will, in the progress of their great work, be so perfectly developed, the greatest praise is due. The map of the city of Londonderry, and all the plates, are perfect specimens of engravings. We shall give an analysis of the "Memoir," as far as it is within the legitimate range of our own department.

The trigonometrical survey of Ireland was principally undertaken with a view of correcting the unequal pressure of taxation; and in order to effect this object, minute and accurate

* Published for Her Majesty's Government. Hodges and Smith, Dublin.

formation as to local boundaries, the nature and quality of ifferent town-lands and districts, the capabilities of improve- ient by opening lines of communication, became of obvious nportance, full and general knowledge is required for such pur- oses, as the foundation of every movement in public works and ical impediment, and the accuracy, as well as total impartiality, f such a national cyclopædia as we are now treating of, must orm a basis or standard for reference, in every outlay of na- ional expenditure, of the most satisfactory and infallible nature. The necessity of executing any particular works, must depend ipon general statistical knowledge.

" The direction in which a railroad or canal should be made, might be in- icated by the maps, but the necessity for making it must be sought in the bjects to be attained by it when made."

We have, however, to regret, that the time required for the urvey and maps is so considerable, as to render it highly pro- able that the statistics of all the Irish counties, with their re- pective baronies, will not be given to the public until many ears shall have elapsed.

" Still what has been done once may be done again, and done better the econd time. The initial steps of every extensive work are of necessity slow. A time wholly disproportioned to the apparent result must be consumed in the collection of material, and in the preparation of their assistants by the several persons entrusted with the different parts. These preliminary labours have been encountered, and it is hoped overcome; they are similar to those which impeded the publication of the early maps, and there is no reason to doubt that if it should be the pleasure of Government to continue the work, the result will be equally successful."

We pass over almost altogether the annals and history of the city, comprising a very large portion of the work, only noticing the extraordinary unanimity which prevailed in 1789 on the centenary celebration of the opening of the gates of Derry. On that occasion Dr M'Devitt, the Roman Catholic Bishop of Derry, and several of his clergy, accompanied the Earl of Bristol, then the Bishop of Derry, Dean Hume, and a numerous body of the clergy of the Established Church, with the Presbyterian ministers and elders, in procession to the cathedral, in order to celebrate the triumph of civil and religious liberty. The anniversary of the opening and shutting of the gates has been for some years past the occasion of such political tumult

as to have rendered it necessary to abandon the solemnity altogether.

The character of the inhabitants of Derry still possesses much of its original features: gravity, solidity, and that indisposition to frivolous amusements, which marked the Presbyterians who were first planted there from England. A considerable infusion of Scotch colonists has also tended to give the tone of religious seriousness which it still bears. "It is manifested by the appearance of the city at night, when the streets, at a comparatively early hour, are nearly deserted, and the repose of the inhabitants rarely disturbed by the noise of the drunken brawler. It is exhibited still more remarkably on Sundays, and every thing indicates strict order, decorum, and a scrupulous observance of the Sabbath. It is apparent, also, in the prevailing indifference to public amusements, to polite literature, and to the fine arts. The theatre has been converted into a coach-house (the present amateur theatre, originating with the officers of the garrison, is of a temporary nature, and this unique theatre has been licensed but for one night); the concerts have been discontinued; the coteries, presided over by a king and queen of the night, have died away; and even the horse-races are probably less attractive than the meetings of the farming societies, and seem marked with all the symptoms of decay. These results are in part traceable to the absorbing influence of political as well as of religious enthusiasm, and in part to more local causes."

"Of the extent of habits of intemperance among the working classes in Derry, though perhaps less than in most towns, the most melancholy statements are given from local authorities, in the Appendix (C) to the First Report of Commissioners for inquiring into the Condition of the Poorer Classes in Ireland."

"The masons, carpenters, and sawyers are in constant employment from May to November; in the other half year the masons, in particular, undergo great vicissitudes. Of the sawyers, about one-half are employed in winter; they generally occupy only one room, at a rent of from 15s. to L.1 a-quarter, and their appearance is inferior to that of the other mechanics. The coopers, in general, have steady employment throughout the year. Of the tailors, about one-third are employed in winter; this trade is the most notorious for drinking. The coachmakers, the class who receive the highest wages, are also of dissipated habits. The shoemakers, on the contrary, are generally sober and well-behaved. The difficulties of the mechanics, in general, are greatly increased by the total absence of employment for their children."

Among the labourers of Derry great poverty prevails, from the want of steady employment, and their consequent exposure to dissipation, together with the total absence of employment for their children. The better class inhabit huts, which let for about L.3 a-year; but the poorer frequently lodge in garrets, or out-houses, chiefly in the bogside, at a rent of about 1s. 3d.

a-week, and yet even in these hovels they contrive to let shares of their rooms at 6d. a-week.

"A great number of the labourers are from the mountains of Donegal. The majority are employed in serving masons, &c. from May to November; the rest in provision-yards, &c., and in casual works during the export season, from November to May. Their only resources, when unemployed, are the pawnbrokers, and, in some instances, small potato-patches. When enfeebled by age or disease, their condition is such as it would be painful to describe, but which is only an epitome of the wretchedness that prevails among the lower orders throughout Ireland. Upon the whole, however, the state of the Derry labourers is said to be improving, especially in respect to the education of their children."

The rate of labour in the rural districts is 8d. and 10d. per day. The labourers are cottiers, without land, but allowed half an acre of oats sown for them, potato-ground (for their own manure), and half a rood of flax, they finding their own seed. For these privileges they are charged about L.5 per annum. The women can earn only three half-pence or two pence a-day at their spinning-wheels, but when the families are numerous, and these wheels constantly occupied by some individual of the family who would otherwise be totally unemployed, the advantage derived from this source of employment is in various points of view very considerable.

There is now some spinning machinery at Strabane, and no one in the present day can deny that the results of machinery are most beneficial to the community; but in a really moral (and surely this is a very essential one) point of view, the congregation of families in spinning and weaving factories is not desirable. The hum of family industry in the cottage gives very different impressions to the philanthropist from those which he receives on entering the crowded factory: the weavers are usually husbandmen also. In Londonderry spinning and weaving have hitherto been almost entirely carried on in the isolated habitations of the labourer and small farmer, and the manufacture is, we hope, now reviving.

Under the section of productive economy there are various interesting tables (commencing with the year 1771) of imports and exports of Derry, to and from various parts of Europe and America; but these we pass over, with a reference only to some entries, which shew the increase of trade between Great Britain and Derry within the last *nine years* from the weighmaster's account.

Exportations to Great Britain from 1826 *to* 1834.

Articles Exported.		1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835. Steam Vessels.	1835. Sailing Vessels.	Total.
Beef, . .	Tierces,	130	103	108	831	2,485	1,428	1,219	2,781	2,357	2,399	787	3,186
Butter, . .	Firkins,	34,510	51,970	48,759	36,952	24,096	26,576	39,821	42,554	46,494	65,645	768	66,413
Corn,—Barley, .	Tons,	573	1,339	1,732	1,661	1,698	1,665	621	538	673	0	0	0
Ditto, Oats, .	Do.	8,467	11,253	19,725	21,262	18,710	19,819	14,192	16,649	18,536	4,119	14,194	18,313
Ditto, Wheat, .	Do.	88	83	79	33	83	224	301	348	536			
Ditto, Oatmeal, .	Do.	1,084	558	923	786	468	1,008	846	2,580	3,170	998	1,150	214
Ditto, Flour, .	Do.	49	0	37	4	3	64	1	15	0	51	0	51
Seed,—Flaxseed, .	Hhds.	0	299	108	0	84	231	373	670	436	0	1,088	1,088
Spirits, Whisky, .	Punch.	5	41	20	7	9	352	293	125	110	0	519	519

Importations from Great Britain from 1826 *to* 1834.

Articles Imported.		1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835. Steam Vessels.	1835. Sailing Vessels.	Total.
Seed,—Clover, .	Tierces,	0	0	32	0	0	83	57	40	39	0	151	151
Ditto, Flax-seed, .	Barrels,	500	2,318	347	0	0	0	0	0	0	2,842	24,424	27,266
Ditto, ditto, .	Hhds.	187	393	1,130	1,004	0	727	1,004	876	1,085	0	0	0
Spirits,—Whisky, .		429	.710	518	1,028	800	783	663	475	330	1,031	60	1,091

From a return made in July 1835, by an eminent merchant in Derry, it is estimated that in that year there were 56,000 hhds. of flaxseed sown in Ireland, covering 144,000 acres (probably Cunningham measure) of land, producing 36,000 tons of flax. The rule of calculation with this gentleman has been, that Derry alone sold about one-fourth of the seed imported into Ireland.

Emigration from the port of Derry has been very considerable, and no doubt a number of weavers have been among the number, though, we believe, by far the largest proportion of emigrants have been drafted from the middling class of farmers, who have taken no little capital with them. It may be gratifying to compare the numbers who have gone to our colonies with those who preferred the United States.

Years.	British Colonies.		United States.	TOTAL.
	St John's.	Quebec.		
1832,	2,396	2,607	2,640	7,643
1833,	1,789	1,523	2,730	6,042
*1834,	1,432	1,082	1,402	3,916

Of the different classes going out it is stated, that the upper generally prefer the States, being the country in which they had friends already settled for many years. Independent labourers, and a few mechanics also, take shipping for New York or Philadelphia, and that the labouring emigrants, who take shipping for Quebec, are rather more respectable than those who choose St John's, most of whom endeavour to make their way thence to the United States.

Vast numbers of emigrants from Ireland have unquestionably left

" The home of their fathers, the land of their birth,"

from the dread of another domestic rebellion; and those who have gone to the Canadas, have had the woful cause to remember the old adage,

" Out of the frying-pan into the fire."

It is now to be seriously apprehended, that with the most re-

* The return being dated the 14th of May 1834, only the earlier emigration of that year is given.

spectable portion of our exiles, a prejudice will, for a considerable time, exist against further emigration into our Canadian settlements, the tide will roll towards the United States. It should be matter of serious interest, anticipating the subsidence of the anti-British feeling now existing in some of our North American possessions, to estimate the powers which, humanly speaking, we possess of giving a fresh impulse to the location of settlers in those portions of the transatlantic territories, where good land is now unoccupied, and available to the development of new and almost illimitable resources. Besides the British companies, which have so powerfully aided emigration on the ordinary plan of selling lands, there has lately been incorporated an Irish Colonization Society, with powers vastly greater than those enjoyed by the other associations. One of their objects (if they should succeed at this unpropitious period in filling their share list) is to let farms, with portions cleared at the expense of the company, at low but remunerating annual rents, to settlers with adequate means sent out by the company, or at least conducted from their ports of landing to their locations, by intelligent agents, providing every thing necessary for their immediate sustenance and agricultural labours. The pressure of these being withdrawn from the parent country, there would be corresponding employment for those of the same, or of an inferior grade remaining. The new Poor Law Bill contemplates emigration as an auxiliary measure of relief for the pauperism of Ireland, and *now* that the Ministry must see the impolicy of not strengthening British connexion in the Canadas, now that they are emancipated, as we venture to hope, from subjection to that party in the House of Commons, which, either from self-interest, or very mistaken policy, has promoted disaffection in our colonies, and endeavoured to cause a total severance of the ties which ought to subsist between Great Britain and its offshoots, there will be an excellent opportunity of making the company in question, and other associations, the means of relieving the mother-country from the pressure of supernumerary hands which ought to be employed *somewhere* in productive industry. The sale of Crown and other lands to the different associations, would at once furnish the means of supplying the wastes with inhabi-

ants. There are some good remarks on this subject in the memoir.

"The emigrants in 1834 were conveyed by about 44 vessels; and it is a remarkable fact that $\frac{1}{17}$th of the whole number alone exceeded 40 years of age. Prior to the end of July 1835, about 3628 persons have emigrated, and of that number even a still smaller proportion exceeded 40 years of age. The great bulk, therefore, of the emigrants were productive agents, in the full vigour and exercise of all their physical powers. This view of the case justifies a few brief remarks on emigration as a means of relieving pauperism, now so frequently advocated by philanthropists. First, then, it should be premised that no restriction should be placed on voluntary emigration, which may be received as the export of any other redundant article, more particularly so, as the means of export must have been procured by the previous exertion of productive energy, and consequently, have so far advanced the public good; but, that admitted, it seems very doubtful, whether the same objection do not apply to bounties on emigration, which have been so often and justly urged against such bounties, when applied to force forward any other branches of trade—or even a still more powerful one, since in such cases some exertion must have been made to produce the article in order to claim the bounty, whereas in this, whatever is paid by the public relieves the intended emigrant from the necessity of so much exertion; but the most powerful of all objections is its probable inefficiency, since it is reasonable to suppose that the greater the demand for an article, or the greater the facility of conveying it to a profitable market, the more it will be produced; encouragement, therefore, to emigration is encouragement to propagation, and tends to augment that carelessness about the results of improvident marriages which have always been considered a national evil, whilst, to produce any marked effect on the social system, it would be necessary to withdraw from the country masses of the population, and to devote for the purpose funds in extent far beyond what has yet been contemplated by the government. It would certainly be wisdom in America, requiring augmented population, were she to offer such a bounty, but it can scarcely be so in England, as she is thus paying for the production of an article intended solely for the use and benefit of another country. The remarks which have been here made, apply to the question of emigration viewed as one of profit or loss to the country which supplies the emigrants, and, in so doing, withdraws from home application a certain portion of its productive resources. The great philosophical question of benefiting the human race by transplanting a certain portion from an unfavourable to a favourable position, or by opening new fields for the exercise of productive agencies, has been already adverted to; but even in that enlarged sense, the question is intimately connected with those of home production and prosperity. For instance, colonies such as those of the ancients, which, in numerical strength, bore a large proportion to the parent community, carried with them at once the habits, feelings, and powers of the mother-country, and became, therefore, merely an extension of its original space; they at once operated as a relief to the mother-country, and often became estranged from it by the necessity of giving up old habits and feelings, and

assuming new, as more suited to the altered circumstances surrounding them. Whilst, therefore, it is the interest of the country requiring augmented population to encourage emigration, even by premiums, the well-peopled country should remain passive; allow, indeed, its surplus population freely to remove, but not by bounties, to render itself a nursery for the labour of other countries. The right mode of interference, if any, would be this—to raise by the sale of Crown lands, in the Canadas or other colonies, a fund to facilitate the settling of those emigrants who had, by their own exertions, raised the means of paying for their outward passage and support. The knowledge of such facility would be sufficient to induce the active and industrious man, anxious to change his condition, to labour for the required means of transport; and none but industrious persons would be enabled to emigrate to countries in which the want of active habits must inevitably lead to misery.

We have been exceedingly pleased with the following clear exposition of the fallacy into which so many persons fall,—several of our Senators included,—respecting the supposed opposition between the agricultural and commercial interests; we have never read any thing which puts in so clear a point of view the *connexion* between those branches of national economy, and the expediency of considering them as part of a continuous chain which should be *rivetted*, if not *welded*, together.

"It is necessary to keep constantly in view this important principle, that application of external power to production, whether it be exhibited in mere manual labour, aided only by implements of husbandry, or in the more compound state in which it is developed in manufactures, is still a form of one and the same thing,—the term *manufactory* implying a work not distant from primary production, but either auxiliary or supplementary to it,—so that the manufacture of woollen goods is still a part of the agricultural system, being supplementary to the breeding of sheep; the manufacture of linen to the culture of flax; the manufacture of cotton goods to that of cotton; in the same manner the operations of the corn-mill are supplementary to the growth of corn,—a sound and wholesome principle calculated to remove those obscurities and prejudices which at present perplex the inquirer in his estimate of the relative importance of agriculture and manufactures, and to lead him to consider them two distinct things, though they are really parts of one." "The principle here laid down does not terminate with manufactures; it may be continued even into *trades*, which can be thus allocated to their respective heads of production. The baker follows the miller, as the miller succeeds the farmer; the shoemaker the tanner; the tanner, in like manner, the farmer; and, if the system be pursued to its full extent, the shopkeeper becomes auxiliaries also to the production, and may be classed among some one or other of the trades of distribution. This is the system adopted in this memoir; and the simplicity which results from its use is abundantly manifest in the series of tables which close the present section."

In the parish of Templemoyle, to which the published volume of the survey is confined, there is a good deal of bog and waste, the proximity of the Donegal mountains affording the facility of grazing young cattle at from 10s. to 15s. per head during the summer half year. The quantity of pasture-land in this portion of the country is inconsiderable. The loss of manure to the farms, consequent on this system of feeding cattle extraneously, is compensated, however, by proximity to the city, where ample supplies of manure can be obtained. We ourselves have had opportunity of knowing that Mr Gage has found on the banks of Lough Foyle marl (covered at high water) which is peculiarly good for his sandy soil; and on the part of the Lough opposite to the property of the Grocer's Company there is an inexhaustible, ever-renewing bank of shells. The number of small holders in the county is very considerable, and these can generally procure lime to mix with bog earth and clay, when dung is not available, for compost. It is stated that wheat culture, formerly considered unsuited to the soil and climate, is advancing in the parish of Templemoyle. This is probably correct, but with respect to the *county at large*, of which much of the soil is thin and cold, we are of opinion that oats are a more suitable and certain crop, and that barley is more certain on the alluvial lands. The soil throughout the county is, however, so varied as to render different rotations and modes of culture desirable. The rich and fertile vales of the Roe, the Faughan, and the Foyle are well suited to barley crops; and, if contiguity to the sea does not render blight a subject of apprehension, to wheat also. The borders of Lough Neagh, with Slieve Gallion on its southern extremity, are low, with only a few gentle swells presenting a rich landscape, interrupted, however, by some extensive bogs, which we should suppose are easily reclaimable from their contiguity to sea manure.

The vale of the Roe consists of gravelly loam, with little absolutely unproductive land even on the adjoining higher grounds, which are of clay. Bond's Glen, resting on a limestone bottom, is especially fertile. In the vale of Faughan there is much good loam; and in that of Mogola there is much rich alluvial soil, exposed, however, to violent inundation and loss. The extensive flats on the Foyle (which noble estuary, though very nar-

row at its entrance, expands in one part to a breadth of seven miles, receiving in its channel the Roe with its tributaries, and runs a length of fifteen miles to the city of Derry,) are of strong loam, gradually diminishing in depth and fertility as they recede from the river. The half valley of the Bann, which runs to Coleraine, is also very rich.

The lovers of fish, as may be supposed from the contiguity of the Atlantic, are amply gratified with all the ordinary kinds. The salmon fishery at Coleraine, superior in extent to any other in Ireland, is a source of considerable profit and employment, but the "Memoir" states, "that, though a valuable auxiliary to other sources of production, the salmon fishery would of itself be a very feeble resource, and that its powers of increasing national wealth are far smaller than is usually believed." Inland navigation from Coleraine, by a canal or lateral cuts along the Bann, if ever perfected, will be of great importance to that very thriving town, the shallows, and bar, where the river *debouches* into the Atlantic near Coleraine, unfortunately obstructing the navigation to the town.

Little is said about the breed of horses or of cattle, except that on the small farms where grazing cannot be much attended to, the common Irish breed is best suited to the indifferent food it obtains. Sheep farming is stated to be discouraged in the parish of Templemoyle,—to which, it is to be remembered, the survey report is confined,—pasture there is very limited, and forced meadows are rare; when broken land is intended for meadows, perennial rye-grass and red clover are sown, and, if for grazing, white clover is preferred, with white grass seeds (*Holcus mollis* and *lanatus*), more owing to custom than to their merits as superior grasses, for although they produce a considerable crop even on light sandy, and more on damp, boggy ground, they are rather disliked by cattle, particularly by horses, as is remarked by Mr Sinclair (*Hort. Gram. Woburnensis*), who recommends that "hay made of these grasses should be sprinkled with salt, cattle preferring such grasses as have either a subacid or a saline taste."

We learn from another source, that the breed of Scotch Highland horses is general in Londonderry county, with a cross with a larger and more powerful horse: many of the mountain horses

are of a slight but active make. A cross with the blood horse has also been introduced; but this, for farmers, is generally very disadvantageous, the mares being usually miserably slight, long-legged and light-bodied, requiring stout compact draught-horses to correct the bad points of the dams in the offspring.

The succession of crops, as we have ascertained by personal observation, in the hilly districts, where a thin clay soil prevails, is *oats*; after the land has rested in pasture, or succeeding potatoes, *oats* again, or flax without manure; after flax, oats again; then pasture or potatoes, if manure can be afforded. This is a pretty specimen of upland farming. If barley be the grain, it succeeds the potato crop, but *oats* is in almost every instance the grain on the high and inferior lands which form so large a proportion of the county. The species of oats here used, is the Angus. The poor plant the lumber potato; and until within a very few years, *cups* have not been introduced. The kind of potato cultivated in the better description of lands has been, for early crops, the *white downs*; for the general crop the *red downs* and *English reds*. It has been told to us, that in the cup potatoes, brought from the adjoining county of Tyrone, no failures occurred, when deficiencies in the crop were generally complained of throughout Ireland. We have already said, or intended to say, that the varieties of soil occasion corresponding variations in the combinations of succession. Flax, for instance, instead of corn, frequently succeeds potatoes, and a prime acre will yield 72 pounds of clear scutched flax; and this is generally prepared for the home or Scotch market, with very rude machinery, a car-wheel, or some such implement being used to break it, where the quantity is small, and the hands are few.

The neighbourhood of Newtown-Limavady is highly cultivated, and there are grown—an unusual sight in most parts of the county—large fields of turnips. Mr M'Causland of Fruit Hill, and Mr Gage of Ballyrena, cultivate them very extensively, and exhibit, as do many other gentlemen in that district, fine specimens of husbandry. By the way, it is remarkable that there are only *four* or *five* private families possessed of estates in fee throughout the county; of these, the Marquis of Waterford is the principal; Mr Brown of Cumber, is another one, by purchase, and his beautifully undulating lands are well planted.

It is gratifying to learn, that nurseries, as a source of production, are on the increase. With the exception of the proprietors just referred to, the whole county is the property of the twelve English companies, forming "the Irish Society," which, in 1613, was incorporated by James I, under the designation of "the Society of the Governor and Assistants of London, of the new plantation in Ulster, within the realm of Ireland." The stipulations by which the county was held were never strictly fulfilled, and, in 1637, the charter was cancelled, but Cromwell fortunately restored it to the Society, and Charles II. renewed the charter almost as it originally was framed. Four of these companies sold their estates to the individuals whose representatives now possess them.

The most spirited and improving of the societies is the Fishmongers. The Grocers' property is comparatively small, but they are furnishing good examples of practical improvement especially at Muff, a beautiful model of the village kind, and by their liberality to the agricultural seminary at Templemoyle, inducing a system of perfect husbandry.

In a recent number of the Irish Farmer's Magazine we find that this school is flourishing; that sixty pupils at L.10 a-year each (recommended by the original shareholders of L.25 each) are reaping the benefit of the practical education supplied, and that "upwards of two hundred young men from sixteen different counties in Ireland have passed through or remain in the school; of these between forty and fifty have been placed in different situations,—such as land-stewards, agents, shcoolmasters and clerks, or employed on the Ordnance Survey; nearly one hundred are now conducting their own or their fathers' farms, in a manner very superior to that of the olden time; and the accounts of those who have been placed from the seminary, are such as to gratify the gentlemen who have its interest at heart, and to convince them that the good seed sown is producing an ample and valuable harvest."

The North-west Society associated in 1821, originated the plan and founded this school. It is now a matter of much regret that that valuable agricultural association has ceased to exist, *except through the branches which sprung from it.* While they existed, their operations were very spirited; they offered (besides the ordinary farming premiums) prizes for the best statistical reports of parishes; for the best specimens of woollen manufacture, and of hats in imitation of Leghorn: at one period,

there were 220 subscribers, and their funds amounted to about L.1000. The offspring societies of the county are in operation, and we trust that their dissolution is far distant. We shall close our article with one other extract from the Ordnance memoir, bearing on a very interesting branch of rural economy, and expressed with the point and vigour which we think characterize, in a remarkable degree, the portions of the work which we believe to emanate from the pen of Captain Portlock.

"The improvement, however, of cottage husbandry is still a desideratum; and it would, perhaps, tend to promote it, were the agricultural societies to keep in view, that the great majority of farms are small, and that the premiums to affect them should be such as would apply to very small spaces,—for instance, for a single cow stall fed, for a certain quantity of cabbages, &c. —and should always be accompanied by an announcement, that the seed of the particular sorts of vegetables recommended, might be procured for reasonable prices, at named establishments,—a very great point in bringing about improvements, being the removal of the small difficulty at the beginning, to overcome which, a much greater share of resolution is often required than to surmount infinitely greater difficulties at a more advanced stage of the experiment. Were this principle also extended to horticultural societies, so as to induce an improvement in the taste of the cottager, the greatest benefits might be confidently anticipated, since it may be fairly asserted, that the repetition of moral injunctions or precepts would effect far less towards the civilization of the peasantry, than the introduction of that refinement of mind which is a consequence of floriculture."

D.

ON AN AGRICULTURAL EDUCATION FOR THE SONS OF LANDED PROPRIETORS.

The ordinary education of the landed proprietors of this country is as complete as it can be effected by private tutelage and at public schools and universities. Accomplished in classical learning, literature, or the physical sciences, as each department of study may suit particular tastes, not a few of them have enhanced the literary and scientific character of the country, and some have even conferred lustre on it in the learned professions of medicine, law, or theology; and not to be outdone in the race of honourable distinction by their English compeers, many have participated in the academic honours of Oxford and Cambridge. Yet strange to remark, anxious as landed proprietors certainly are to

bestow a liberal education on their families, which is the best legacy they can leave to their younger sons, agriculture, which most materially affects the interests of themselves and their eldest sons, the very profession by which they are upheld in the high status of society they occupy, they almost entirely neglect, as if, after the acquirement of a superior education, a man should be ashamed of attending to the means of his subsistence. Is it not "passing strange," that any country gentleman should be unacquainted with farming, the very source of his livelihood, when all other classes of people, in learning their respective professions, whether learned or vulgar, serve apprenticeships and toil through life thereafter? It seems to be forgotten that landownership *is* a profession, that it is in the manner in which it is conducted, that the best interests of the country may be injured or promoted, and that it is a profession which requires as great capacity of mind to practise it aright as to conduct those large commercial and manufacturing establishments whose importance is so much lauded. The comparison between them can in truth be pursued no farther; for, whilst commercialists conduct their business in person assiduously, landowners consign the guidance of their valuable estates to persons who, in too many instances, are ignorant of agriculture, and who, at any rate, cannot feel the same interest in their prosperity as the proprietors themselves. This allegation is made against landowners generally, though not indiscriminately sweeping; for we have the satisfaction of personally knowing landowners, members of the nobility as well as the gentry, who have made it a duty to acquire a knowledge of agriculture, and who, in consequence, manage their estates of themselves, or through competent factors, on the principles of the most approved practice. Those proprietors who entrust their estates to factors of known practical ability, adopt the best safeguard against the evils arising from their own want of knowledge.

There are many evils attending the neglect of farming by landowners. When called upon to take a share in the discussions or business of those interesting agricultural meetings which of late years have excited so much notice over the kingdom, the remarks or speeches of the landowners consist, with few exceptions, of apologies for not having attended sufficiently to agricultural subjects, and of excuses for want of practical knowledge;

when it is their lot or ambition to become members of the lature, how lamentable it is to find that, beyond every other of representatives in Parliament, the landed interest know least of what concerns themselves. They should know h more upon every subject connected with agriculture as an as being the most influential interest in the state, or the laws ting the different branches of it, than mere tenants, whose ation and means of observation must be comparatively li- d. Yet the tenantry are frequently left to fight their own les on public questions.

greater evil exists in consigning the management of their able estates to the care of men who have perhaps acquired ntimacy with the quill, and the blandishments of their own s, but who have neglected the guidance of the plough, and unwearying attention required at the feeding-in board. it of knowledge in proprictors may only personally affect iselves, but the appointment of incompetent factors cannot to affect the fortunes and happiness of numerous families. nature of the legal profession in which too many factors are ight up, predisposes their minds to carping at quibbles and iousness; which, whenever a farmer discovers, or thinks he overs, in the factor, he withdraws his confidence from him, places himself in a position of self-defence. Both are ever prepared for disputation, and disputes inevitably ensue. how can any other result be anticipated? How can a farmer "sweet converse" with a man who cannot understand his ourse, and it is only as a farmer that a tenant has occasion onverse with the factor at all? In these circumstances, when utes do arise between the factor and the tenants, the pro- or, who is unwilling, or what is worse, and more likely to e case, unable to interfere, leaves their settlement to him who nenced them; and who, to gain his point over the tenant, uades his master, by flattering his prejudices, to refrain from ference; and, in the end, contrives to place the proprietor in nost disagreeable position with his tenants. The probable re- of this cunning policy is the degradation of the proprietor a scape-goat for the sins of the factor. Or, stopping short of al litigation, the factor may refer the settlement of the dispute xpensive arbitration. In either case, the weaker party, the

tenants, are sure to be most injured, and, it may be, eventually ruined. The proprietor, instead of being the natural protector of his tenants, is thus converted into their oppressor.

By this train of argument, we do not maintain that factors should be ignorant of law, of business, or any other species of knowledge; but what we assert is, that they should be thoroughly versant in agriculture. Without that essential knowledge, we would not intrust a factor with the management of an estate, although he possessed the most amiable disposition. That knowledge, and no other, imparts the faculty of looking at all agricultural matters in the right light. By it he will know what covenants of the lease is applicable to the peculiarities of every farm, or the circumstances of the tenant to whom it is let. No disputes will then arise about miscropping. He will easily discover whether the progressive or retrograde condition of the tenants arises from their own industry or negligence, or from circumstances connected with the state or situation of the farms themselves. He will regulate his conduct accordingly, by encouraging the industrious and skilful, reproving the indolent, or amending the unfavourable circumstances of the farms. Such a man's opinion will greatly influence that of the tenantry, and community of sentiment will produce mutual kindliness of intercourse between them.

Every landowner who resides in his mansion-house in the country, must have as much land in his own possession as to make what is familiarly termed a "home farm." Corn, hay, and straw will be required for the horses; green food throughout all the seasons must be provided for the dairy cows; fowls and dogs must be supported; butcher's meat must be regularly supplied in the best condition; and the whole domestic establishment must be maintained. To effect all this, two hundred acres of arable land, besides lawns and paddocks, are required. A manager for all this establishment must be procured. Another evil arises from the appointment of this functionary. He becomes proud in his new place, because he is in the service of a laird; overbearing, because he knows he is the only one acquainted with the management of land; important, because he finds himself purveyor for the whole establishment, and could starve the garrison at any time to a surrender; haughty, because

disposing of a few unnecessary articles from the farm, he becomes the bearer for a time, of a little loose cash. The temptations of his office become too strong for his virtue, he aggrandizes himself and distributes hush-money liberally; at length his peccadillos are discovered, and he for ever after becomes unfit for a farm steward to any other proprietor or farmer.

When landlords have no knowledge of farming, their taste for the country usually declines. The sports of the field may detain them on their estates for the season, but are too rough and fatiguing to entice them to remain throughout the year. Without the excitement of field-sports, their life is nothing but a monotonous scene, and the same society at length becomes irksome to them. They leave their demesnes with partial disgust, and wander about in foreign lands or settle down somewhere far removed from their patrimonial inheritance. This we consider an evil; for we do not agree with Mr Macculloch, that it is of no importance to a country where the income derived from its land is spent. We are quite sure the small tradesmen of every class derive sensible benefits from the expenditure of the contiguous proprietors, and when the latter are absent, they soon feel that source of profit dried up. But on the other hand, we do not bewail the absence of proprietors so lamentably as our Irish neighbours. Good farming proceeds, and labourers are employed, by the enterprising tenantry in their absence; and, in as far as regards the substantial improvement of the country, the claims of the landowners in the participation of the honour is little compared with those of the tenantry.

Now the effects of all these evils, we venture to assert, may be most effectually remedied by the sons of landed proprietors, who will themselves become landowners, acquiring a thorough knowledge of farming in their youth, as a necessary branch of practical education, and the management of their estates will then be felt a desirable gratification, not a task. Proprietors would then be qualified to select and appoint competent factors,—to judge of the fulfilment of the factor's duty of impartial superintendence,—and to convince themselves, by personal observation, that their tenantry receive substantial justice and protection. They would then be competent to select farm-

stewards to manage the home farm under their own directions, and to keep them in check by commanding them to render an account of their intromissions at the moment, and not at the protracted periods of terms. They would then discover there is not a more rational, pleasing, or interesting study than the science of agriculture, and its practical application, nor one which can be so well combined with those manly sports and amusements in which it is the pride of our country gentlemen to excel. They would then have no temptation to reside abroad, but would discover that a knowledge of the minutiæ of farming creates a daily increasing interest in field operations, and the cultivation of stock. A personal acquaintance with their tenants would then open a wide field of human nature for their observation; and this ample field to glean from, in connection with the facts acquired in their own practice, would supply them with cogent arguments and illustrations on all subjects connected with agriculture, whereby their sentiments would command respect in every public assembly.

Where is all this important knowledge to be acquired? It is to be acquired like every other species of knowledge, by observation; in the operations of nature as displayed in the field of art. Is this question asked in a country, whose proud boast is to possess more enterprising, educated, and well informed farmers than perhaps any other country in the world? In all the best managed districts, where we mean the mixed husbandry is practised, or the culture of stock and crop are combined, there are farmers well qualified to impart instruction in their profession, as well as possessing such cultivated minds as to render them valuable companions. A two-years' residence with an agreeable and intelligent farmer, who practises the raising of corn with the breeding and management of cattle and sheep, and putting to the hand to every kind of work, could not fail to impart to young men of ordinary capacity, a competent knowledge of farming. Such a tuition we consider absolutely necessary for the eldest sons of our landed proprietors, who mean to reside in their own country, and enact the part of landowners; but it may be also profitably extended to those younger sons, who may turn their thoughts to the New World, as the surest means of success in any undertaking connected with the culture of the soil, or the rearing of the domesticated animals, in which they may

embark. Their interests will be promoted by studying agriculture effectually, before they embark in their migratory undertakings. No proprietors' sons need be ashamed to receive instruction from, or sit down at the tables of such men.

We are entitled to speak confidently on this subject; for the foundation of our practical knowledge of agriculture was laid by an intelligent farmer, and most agreeable companion, in perhaps the best county for farming in Scotland; and never since have we had cause to consider the time misspent. The facilities are evidently greater in Scotland than in any country we know, for young gentlemen acquiring a practical knowledge of agriculture, almost under the eye of their friends and relations.

Should these remarks attract the attention of those country gentlemen who may feel inclined to profit by them, we can furnish them with the names of some of the most eminent farmers who have been in the habit of taking pupils; and leave it to their own discretion to choose the most eligible situation.

But we think the system of tuition might be beneficially extended. Most farmers, we apprehend, are not quite competent to teach the science of agriculture in connection with its practice. Suppose then, an extensive farmer has a large house, capable of containing a number of pupils, not exceeding twenty. That number, we conceive, to be enough for successful and comfortable tuition. Let this house be subdivided into comfortable sleeping apartments, a large dining-room, a large drawing-room, and a large class-room, fitted up partly as a library, and useful also as a reading and writing apartment. Let a tutor of competent acquirements be appointed to take the immediate charge of the pupils, both within and without doors. He should be competent to teach the application of chemistry, although we are not so sanguine as most people of the utility of this science to agriculture. He should teach the application of the principles of mechanics, in order that the principle on which any implement operates may be comprehended—the application of the principles of hydraulics, that the principles of draining, embanking, and constructing reservoirs for water may be easily understood. He should teach botany, to enable young farmers to distinguish soils by their natural vegetation; and particularly the physiology of plants, that the culture of plants of what-

ever kind may be in conformity with appropriate soil and situation. Also geology, that the substrata or subsoils on which soils rest may obtain due regard. Meteorology should be studied, in order to be able to anticipate the changes of the weather. The anatomy and physiology of animals are also requisite for him to teach, that the good points of live stock may be duly appreciated. And above all he ought to be acquainted with the practice of agriculture, for although the farmer himself will no doubt undertake to teach this department of the system; yet, unless the tutor also understands it, he cannot so successfully demonstrate the application of science to the operations of practice. It may, at first, be difficult to find a tutor so amply qualified for the task; but as the practice of agriculture would most likely be the only department in which he would be deficient, he could, in the course of two years, acquire that knowledge as easily as any of the pupils.

With colloquial prelections and discussions in the house, at stated hours, so as not to interfere with the hours of labour in the fields, and with demonstrations in the fields, whilst the labour was in progress, a vast mass of useful information would in a short time be conveyed to, and acquired by, the pupils. It is presumed the pupils had already acquired, at school or college, the elementary principles of all these sciences, besides mathematics. Such a house should be situate on a large farm of not less than six hundred acres, on which the mixed husbandry is practised, that is, the growing corn with the breeding and rearing of cattle and sheep.

The system might be extended still farther. It will scarcely be possible to find a sufficient number of large farms on which such establishments could be founded, or of intelligent farmers to conduct them; as the mixed system of husbandry cannot be successfully carried on, on a very small farm, or by small farmers. This difficulty might be obviated by the erection of a large house in a convenient village, in the neighbourhood of which, intelligent farmers held farms. The tutor himself could engage the house, and draw the emoluments, and give premiums to the farmers, for permission to the pupils to inspect and witness all the operations.

We think such establishments would be conducted much

more satisfactorily on private speculation, than under the guidance of any society, or public commission. Both the farmer and tutor would be stimulated by their own interests for their success, and competition would in time sharpen the stimulus still more keenly. Let any farmer who has the requisite accommodation and qualification, begin the experiment with adequate appliances, and he will soon find customers. Like a coach or a steam-boat starting on a new line of communication, his establishment will attract pupils; whereas, if he wait until the demand for such establishments rouse him into action, he may have to wait as long as the waggoner had for the assistance of Hercules.

ON THE CULTURE OF THE GORSE OR WHIN AS FOOD FOR LIVE-STOCK.

By Mr Robert Black, Lachalsh, Ross-shire.

The gorse or whin, as every body knows, is a hardy evergreen shrub, indigenous to most parts of Great Britain, and, when viewed in the light of a weed, one of the most determined growers, and most difficult to get rid of that the agriculturist can meet with. It has, however, long been known as a plant highly nutritious as food for horses, sheep, and cattle, and has probably been neglected from the supposed difficulty of converting it into a state fit to be comfortably eaten by domestic animals, the process of cutting, gathering, and bruising the young shoots, when taken from the old stunted bushes, being both laborious and expensive. These difficulties are, however, comparatively easily overcome, when gorse is allowed the common privileges of a cultivated plant, and the most worthless part of the farm to vegetate upon.

From suggestions made to me by a Warwickshire gentleman, on whose property gorse to a considerable extent is cultivated, I was induced, from the great benefit I saw would arise to a country situated as this is, where winter keep is exceedingly scarce, and, from the variable climate, hay-making both uncertain and expensive, to try a few acres of gorse in the spring of 1834; and following the Warwickshire system, sowed two or three acres along with a crop of barley, and in the suc-

ceeding year about twice that extent of old lea-ground, and from these trials, I plainly saw that what might suit the constitution of the whin in the weedless clay soils of Warwickshire, would not suit it in the grassy and weedy soil of Wester Ross. The result in both cases was unsatisfactory. Among the barley, the seed vegetated freely enough, but from its shading and overtopping, the plants of whin were *drawn up*, of a sickly hue; and, before the next spring, were thrown out by the winter's frost, the slight efforts at vegetation made by the plants that were left during the course of next summer, being generally overcome by the natural grasses. The truth is, the land was in a very unfit state for crops of any description, being both wet and dirty. On the lea-ground, which I must premise was neither ploughed nor harrowed, the gorse had similar difficulties to contend with; but to give the experiment all manner of justice, we did not pasture the field for a year after the seeds were sown, and this we found, when almost too late, was the most speedy and effectual way of frustrating the experiment; for whenever the grass had got up to any length or thickness, the gorse was either choked or drawn tenderly up, and during the succeeding winter and spring, it was very generally rotted or thrown out of the ground. Cattle and sheep were allowed to range over the field as usual, and at the present date (Jan. 1838) the gorse on the lea-field seems to have wonderfully recovered, and will, I think, after being carefully cut over during the course of the winter, and the blanks filled up by transplantation, afford a fair cutting in the winters of 1838 and 1839.

Having thus stated the experiments, in the success of which we have not much to congratulate ourselves upon, I may now relate those trials in which we have completely succeeded. From the hints gathered from past experience, I plainly saw that wherever the gorse had moderately dry soil, somewhat free from grass and weeds, it succeeded to satisfaction. In the winter of 1835 and spring of 1836, I had therefore a bog of sixteen Scotch acres drained, and dug over to the depth of ten or twelve inches, at an expense of L. 6 an acre. The land at the time of sowing, April 1836, I considered in a very unfit state for sowing, as the raw peat had had no time to mellow down to any thing like soil, and the seed was consequently sown over

a raw peat-bog, shewing symptoms of pulverization only where the peat had happened to be more or less mixed with other matter. Contrary, however, to expectation, the seeds vegetated freely, and by October had reached the height generally from four to six inches. The severe spring of 1837 cut off by the ground many of the plants that had been unnaturally drawn up by shading or otherwise, but these all sprung again from the root, and are now the thickest and most luxuriant parts of the field.

At the present date, 15th January 1838, we have been cutting gorse for two months back, and during that time, have kept eight horses, young and old, *wholly* upon them, as also about the same number of cows partially so. The horses are in the yoke every day, and are in excellent condition, although they have not tasted oats this season. The cows have also improved both in milk and condition, since we began to give them a feed daily. From what I have seen of the feeding qualities of gorse, I have no hesitation in saying, that I consider it equal to both oats and hay for work horses, and superior to any kind of food that is usually given to milch cows in winter; the butter and milk from cows fed on it, being equal to those from the finest old pastures during the best part of summer.

The Warwickshire gentleman before alluded to, states, that after the second and third cutting, gorse lands generally let "on foot" at from L. 6 to L. 8 per acre, and are very frequently let to dairymen in the towns; and in some instances, the gorse is carted ten and twelve miles to dairies. I regret not having had time as yet to experimentize upon the quantity and value of gorse raised upon a given space of ground, but from the quantity of stock fed since we commenced cutting, and the extent of ground gone over, I certainly cannot rate the present crop at less than L. 3, and that on land not naturally worth 2s. 6d. an acre. I may here state, that the gorse is cut close to the ground by the scythe, and where the land is smooth and even, the process is not more difficult than cutting rushes or coarse bog hay. The quantity of seed sown on the Scotch acre is generally 20 lb., which I think is an ample quantity. The seed used by me, was said to be the seed of French gorse, and was purchased in Warwickshire at 1s. per lb.

In giving my advice to cultivators, I have to recommend—first, that the land be put in such a state of cleanliness as will allow the young gorse a start of two seasons before it run any risk of being choked or over-shadowed with grass or weeds, there being no further risk after the second season, as the gorse will maintain its ground against every obstacle. I consider it of very little moment what the soil may be, provided it be naturally dry or properly drained, as the plant takes such a deep range in the earth, that what is wanting in the soil in quality is made up in quantity; for a plant that can send its tap-root to the depth of five or six feet, and select its food regularly through a mass of earth of that thickness, may almost be said to be independent of the quality of soils. I am, however, inclined to think, that of all soils, even including its natural soil, clay, the best suited to the luxuriant growth of whin is drained peat, produced from decayed bents, as these always bespeak the proximity of earthy matter; and peaty soils, above all others, can generally be got so perfectly free of weeds that no obstruction is given to the growth of the young gorse from the first starting. Again, from the peculiarly searching nature of the whin, it is capable, above all other plants, of taking the fullest advantage of mossy soil to the depth of five or six feet.

In appreciating the inestimable properties of whin, it seems destined to fill up that blank in vegetation between the decay of herbaceous plants in autumn and their revival in spring, which is partially supplied on light and sandy soils by the turnip. Moreover, it combines the properties of grain and fodder; grows on any kind of soil, if moderately dry, or dried, but more luxuriantly on clay soils, which are inimical to the growth of green crops in winter. It possesses another remarkable property as a green winter plant,—probably arising from a crude state of its juices,—that it is rejected by animals till the season when other plants are falling into decay, and when its luxuriant and nutritious foliage is of invaluable utility; and again, as spring advances and the other plants resume their vigour, it is again rejected by animals; and, as it then puts forth its buds, cutting or cropping is found highly prejudicial to its future growth.

The whin, by any system of culture that we know of, cannot

e raised to a size exceeding a bush; and, from the thinness of he bark and the scarcity of sap-wood, the young shoots proeeding immediately from the root when the bush has been cut r burnt over, are twice the length and thickness of any suceeding shoot. These summer shoots naturally indicate that vinter is the time for reaping whins, and it is they which contitute the winter food for horses and cattle. Thus, every hing conduces to recommend the cultivation of this valuable orage plant; and, although even its young sprigs are armed vith a few innocuous prickles, yet their inconvenience can be vercome by very simple means.

Having already given it as my opinion that a peaty soil is by nuch the most suitable for the cultivation of the whin, I may lso state that, of all the various modes of preparation pracised in different places by which moss lands are *taken in* from vaste, none in my opinion can equal paring and burning as a reparative operation for a crop of gorse, because by this mode very sort of weed and indurated matter can be so completely lestroyed as to leave the soil clear for a series of years. The ishes, too, may be of some use to the gorse plants when very young, but beyond this age I consider them of small assistince to a plant whose roots can roam in search of food in adiesive soils to the depth of six feet.

When properly bruised, horses, cattle, and sheep, after a day r two eat the whin greedily, and thrive upon it amazingly; and, udging that an omnivorous animal would, *à fortiori*, thrive ipon it still better, I have had a mess or two given to pigs vithin these few days, and am glad to say they have taken to it ully as kindly as the other stock on the farm, and have no loubt will thrive upon it well.

Those who wish a speedy and large return from the cultivaion of the whin, will do well to pulverise the soil thoroughly, ind drill and clean it as for turnip, and they will have a partial rop the first season, and a full one the second; whereas by owing broadcast on an unimproved soil, a full crop cannot be expected till the third season.

In regard to the process of bruising the whin to prepare it is food for live-stock, I own myself a little behind in information, as my chief endeavour has hitherto been to get them the

length of being worth the bruising. The method in Warwickshire is simply by a weighty cast-iron wheel, fluted in the circumference, and propelled round a circular trough paved with flat stones or cast-iron in the bottom. There is also a set of knives, on the principle of the chaff-cutter, by which the gorse is cut into short lengths before it falls into the bruising trough. The cutting expedites the bruising very much, and makes the process much more perfect, as by the time the cut gorse has had a few turns of the heavy wheel, it is soft and safe enough for mastication. My own bruiser is a very simple affair, being nothing else than a pair of old millstones bolted together and working on edge in a circular trough, fourteen feet in diameter. The axle which passes through the centre of the stones, is fixed at the end by a pivot to a strong post in the centre of the ring, and at the other end, which is four feet in length, the horse is attached. As a cutter, we use a straw-cutter of the simplest kind; and with these two primitive machines, a man and boy, with the aid of a Highland pony, can cut and bruise from sixty to eighty bushels a-day, a quantity sufficient for twenty horses on ordinary work.

QUARTERLY AGRICULTURAL REPORT.

February 19. 1838.

The Agricultural Report for this quarter may principally be studied in the Meteorological Table of the period. The atmosphere has not shewn so severe a temperature since 1823, and nothing like it in the character of frost since 1814. There has no fair, however, been held on the Thames above London Bridge, as in the latter year, and perhaps never will again, as the removal of the foundations of the old bridge, permits the full action of the water at the rise and fall of the tide to be more sensibly felt. We have not observed the thermometer during the day below 11°, though it must have been below that in the night; and it is said, that in the neighbourhood of Perth it was as low as 2° below zero. The fall of snow has been considerable in the midland counties near the east coast, to the degree of stopping all the coaches but the mail. There has been less snow, and later of falling, in the northern and southern counties; and it was only a fortnight ago that the snow-storm first visited the wildest regions of the Grampians. Immediately preceding the frost, the weather was as mild and balmy as in April, and had it continued much longer,

the turnips would have shot up into flower, and the grass grown green, and perhaps hawthorn buds appeared. As it was, the "tunable breath" of the lark was heard in the air; the song of the merle and thrush poured forth at morn and eve, and the sparrows busily engaged in carrying long straws for their nests. These joyous amusements were repressed in a moment, by the stern command of winter, whose inclemency is still severely felt by the poor.

The crop generally on being thrashed out proves deficient in gift; barley being also coarse, oats not so bad, but the wheat when it comes in hand will be the worst of all in quantity and quality. There are, no doubt, exceptions to be found in some spots, for we have seen one sample of very fine wheat of this crop; some heavy though coarse-looking barley; and oats of good weight, even from Caithness, where some potato oats are 40 lb. to 43 lb. per bushel, early Angus from 39 lb. to 40 lb. and dun from 38 lb. to 39 lb. Less in quantity and inferior in quality as this crop, compared to that of last year, is, the prices are lower than at this period by at least 1s. per quarter for wheat, 5s. for barley, and 4s. for oats.

We regret the omission in this number of the retrospect of the corn trade, furnished by Mr Fearnside. The uncertain state of the crop having been the cause of delaying its appearance last quarter, when it should have appeared, it was sent us the other day in such a voluminous shape, that the space allotted for it was much too small; and to divide such a paper would greatly destroy the general and comparative interest for its contents. It shall appear in the next number; but perhaps it would be the better plan, instead of a half-yearly, to have an annual retrospect, which could be furnished at the most leisurely period of the year.

Sheep must lose condition on turnips in such frosty weather, where the turnips are only partially protected by snow. During the heavy snow-storm in the spring of 1823, we adopted a plan which supplied the sheep with soft turnip, every day, by causing the ploughman to assist the shepherd in shovelling the snow off the turnips on the spaces that had been stripped, every morning after the sun was up, and clearing only as many of the turnips as the sheep could consume till nightfall. Cattle also fall off on frosted turnip. Frosted turnip may soon be thawed in tubs of cold water, but what is a much better plan, as many should be stripped from the land in the beginning of winter, and stored past, as would serve the cattle until spring.

With regard to the future prospects of the farmer, judging from analogy, we anticipate a good summer. The summer of 1814, after the severe frosty spring, was good; and should this storm be the harbinger of as fine a summer and splendid a crop in 1839, as that of 1814 was of the beautiful crop of 1815, the people will have no cause to complain on the score of food, and the farmer will have cause to rejoice, in the midst of abundance.

TABLES OF PRICES, &c.

The Average Prices of the different kinds of GRAIN, per Imperial Quarter, so
following Markets :—

LONDON.

Date.	[redacted] s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
1837.												
Nov. 3.	54	1	32	7	22	0	30	8	36	1	33	2
10.	52	8	32	1	21	2	31	6	35	4	33	0
17.	56	1	32	7	21	6	30	9	36	7	33	10
24.	56	9	32	1	21	7	29	10	35	2	35	1
Dec. 1.	55	4	31	5	21	10	30	4	35	0	34	7
8.	54	6	31	2	21	1	29	6	34	8	34	7
15.	54	4	31	4	21	11	30	2	34	6	34	8
22.	55	11	30	5	21	6	29	2	33	9	33	3
29.	54	4	30	3	21	5	28	10	32	8	33	1
1838.												
Jan. 5.	53	5	31	7	21	4	29	6	33	6	34	1
12.	53	0	30	8	21	3	30	4	32	8	32	3
19.	55	8	30	7	21	4	31	6	32	6	32	0
26.	56	4	28	3	21	9	30	2	34	2	34	5

DUBLIN.

Date.	Wheat Per Bar. 20 St. s.	d.	Barley Per Bar. 16 St. s.	d.	Bear Per Bar. 17 St. s.	d.	Oats Per Bar. 14 St. s.	d.
1837.								
Nov. 3.	29	2	15	6	11	6	13	2
10.	28	10	14	8	11	3	13	0
17.	28	7	14	10	11	0	12	6
24.	28	4	14	6	11	6	12	2
Dec. 1.	27	8	14	10	11	10	12	0
8.	27	6	15	0	11	6	11	2
15.	27	10	15	4	11	9	11	8
22.	28	4	15	6	11	6	10	10
29.	29	6	15	4	11	10	10	8
1838.								
Jan. 5	30	6	15	0	11	9	10	6
12.	31	6	15	6	12	4	10	8
19.	32	0	15	0	12	2	10	6
26.	31	6	15	3	12	0	11	0

LIVERPOOL.

Date.	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
1837.												
Nov. 3.	47	9	30	9	19	11	31	6	36	10	42	3
10.	49	8	28	8	20	11	30	9	37	8	42	9
17.	48	7	27	3	20	0	30	6	35	9	41	3
24.	50	10	27	1	20	2	31	2	35	3	40	5
Dec. 1	49	7	31	4	19	10	30	4	34	10	41	7
8.	48	10	29	4	19	10	29	8	36	8	39	4
15.	51	0	29	1	20	2	30	6	35	9	41	11
22.	51	9	31	2	20	1	28	10	38	6	39	2
29.	52	4	35	0	19	6	29	9	37	8	40	0
1838.												
Jan. 5.	50	3	31	10	20	2	29	10	38	2	41	4
12.	52	5	32	0	19	2	30	8	37	5	37	0
19.	53	10	29	10	19	9	31	4	37	2	38	3
26	56	7	28	9	19	8	30	8	38	6	37	1

EDINBURGH.

Date.	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Pease. s.	d.
1837.								
Nov. 1.	58	0	30	8	23	0	38	6
8.	58	1	30	6	22	3	38	0
15.	58	6	31	6	22	0	38	0
22.	57	6	30	10	22	1	37	8
29.	57	9	29	5	22	6	37	8
Dec. 6.	57	6	29	2	21	10	36	6
13.	57	0	30	3	21	8	36	6
20.	56	10	29	2	22	4	36	0
27.	56	6	29	3	21	7	35	0
1838.								
Jan. 3.	56	3	29	9	21	9	35	2
10.	57	4	30	2	22	2	36	1
17.	58	0	30	0	22	8	34	8
24.	59	8	30	6	22	10	34	6

TABLE showing the Weekly Average Prices of GRAIN, made up in terms of 7
Geo. IV. c. 58, and the Aggregate Averages which regulate the Duties payable on F
CORN; the Duties payable thereon, from Nov. 1837 to Feb. 1838.

Date.	Wheat. Weekly Average. s.	d.	Wheat. Aggregate Average. s.	d.	Wheat. Duty. s.	d.	Barley. Weekly Average. s.	d.	Barley. Aggregate Average. s.	d.	Barley. Duty. s.	d.
1837.												
Nov. 3.	51	7	53	4	33	8	30	8	30	0	16	10
10.	52	11	52	9	34	8	31	5	30	3	16	10
17.	54	4	52	6	34	8	30	0	30	4	16	10
24.	53	7	52	6	34	8	30	1	30	5	16	10
Dec. 1	52	6	52	6	34	8	29	5	30	3	16	10
8.	52	6	52	11	34	8	29	2	30	4	16	10
15.	53	5	53	3	33	8	29	9	29	10	18	4
22.	53	2	53	3	33	8	29	3	29	8	18	4
29.	52	9	53	0	33	8	28	0	29	4	18	4
1838.												
Jan. 5.	51	4	52	1	34	8	28	10	29	1	18	4
12.	52	10	52	11	34	8	24	10	29	0	18	4
19.	53	7	53	0	33	8	28	9	28	11	19	10
26.	54	10	53	3	33	8	28	0	28	10	19	10

Date.	Oats. Weekly Average. s.	d.	Oats. Aggregate Average. s.	d.	Oats. Duty. s.	d.	Rye. Weekly Average. s.	d.	Rye. Aggregate Average. s.	d.	Rye. Duty. s.	d.
1837.												
Nov. 3.	21	5	22	1	13	9	30	0	31	6	22	9
10.	20	9	21	5	15	3	31	1	31	3	22	9
17.	21	1	21	6	15	3	28	2	30	6	24	3
24.	21	2	21	5	15	3	30	8	30	3	24	3
Dec. 1	21	0	21	3	15	3	30	4	30	3	24	3
8.	20	8	21	1	15	3	28	5	29	11	25	9
15.	20	11	21	0	15	3	30	9	29	11	25	9
22.	20	5	20	10	16	9	28	0	29	4	25	9
29.	20	2	20	8	16	9	26	10	29	2	25	9
1838.												
Jan. 5.	20	1	20	6	16	9	31	6	29	4	25	9
12.	20	2	20	5	16	9	27	7	28	10	27	3
19.	19	11	20	3	16	9	27	11	28	9	27	3
26.	20	0	20	1	16	9	30	8	28	9	27	3

Date.	Pease. Weekly Average. s.	d.	Pease. Aggregate Average. s.	d.	Pease. Duty. s.	d.	B[eans]. Weekly Average. s.	d.
1837.								
Nov. 3.	35	0	35	11	16	9	37	7
10.	35	4	35	9	16	9	36	7
17.	35	8	35	7	16	9	36	6
24.	35	0	35	4	16	9	37	3
Dec. 1	34	6	35	3	16	9	36	9
8.	35	0	34	1	16	9	36	[illegible]
15.	34	7	35	0	16	9	35	[illegible]
22.	33	11	34	9	18	3	34	[illegible]
29.	33	10	34	5	18	3	34	0
1838.								
Jan. 5.	32	8	34	1	18	3	32	11
12.	33	0	33	8	19	9	33	4
19.	32	7	33	3	19	9	33	6
26.	32	8	32	10	21	3	33	4

'ONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Quantities of orn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quantities on which duties have been paid for home-consumption, during the same Month; and the Quan- ies remaining in Warehouse at the close thereof, from 5th November 1837 *to 5th January* 1838.

	IMPORTED.			CHARGED WITH DUTY.			REMAINING IN WAREHOUSE.		
	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.
37.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.
.	30,440 3	48 1	30,488 4	25,030 4	1,810 7	26,811 3	396,792 7	8,957 1	605,749 0
.	52 2	..	52 2	80 0	..	80 0	39,465 4	..	39,465 4
.	9,101 2	..	9,101 2	8,496 1	..	8,496 1	250,999 2	..	250,999 2
.	534 7	..	534 7	..	..	..	13,386 2	..	13,386 2
.	1,119 7	..	1,119 7	329 3	..	329 3	21,687 4	..	21,687 4
.	2,718 3	..	2,718 3	27,308 4	..	27,308 4	3,461 5	446 0	3,907 5
..	43,967 0	48 1	44,015 1	61,244 4	1,810 7	63,055 3	925,793 0	9,403 1	935,195 1
.	13,882 3	0 1	13,882 4	107 1	975 5	1,082 6	595,977 3	7,981 5	603,959 0
.	2 2	..	2 2	943 0	..	943 0	38,389 1	..	38,389 1
.	8,227 7	..	8,227 7	370 7	..	370 7	251,740 7	..	251,740 7
.	973 4	..	973 4	..	..	..	12,060 5	..	12,060 5
.	1,769 0	..	1,769 0	654 5	..	654 5	22,425 1	..	22,425 1
.	2,359 1	..	2,359 1	1,504 4	..	1,504 4	4,314 2	..	4,314 2
.	27,214 1	0 1	27,214 2	3,580 1	975 5	4,555 6	924,907 3	7,981 5	932,889 0
18.									
.	16,672 1	..	16,672 1	95 5	469 0	564 5	581,947 1	7,512 5	589,459 6
.	1,022 6	..	1,022 6	1,229 4	..	1,229 4	36,980 7	..	36,980 7
.	4,416 3	..	4,416 3	8 6	..	8 6	251,269 6	..	251,269 6
.	999 6	..	999 6	..	..	..	12,046 7	..	12,046 7
.	1,240 4	..	1,240 4	420 4	..	420 4	22,795 4	..	22,795 4
.	695 2	..	695 2	261 7	..	261 7	4,670 3	..	4,670 3
.	25,046 6	..	25,046 6	2,016 2	469 0	2,485 2	909,710 4	7,512 5	917,223 1
37.	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb
.	16,115 2 21	8,131 0 15	24,246 3 8	16 2 14	3,412 1 7	3,428 4 21	145,327 1 11	27,945 0 3	173,272 1 14
.	..	..	..	..	..	..	315 0 4	..	315 0 4
.	16,115 2 21	8,131 0 15	24,246 3 8	16 2 14	3,412 1 7	3,428 3 21	145,642 1 15	27,945 0 3	173,587 1 18
.	18,876 2 1	2,415 3 11	21,292 1 12	30 3 22	4,363 2 22	4,394 2 16	144,414 1 4	25,054 1 24	169,468 3 0
.	21 1 20	..	21 1 20	..	..	..	264 0 14	..	264 0 14
.	18,897 3 21	2,415 3 11	21,313 3 4	30 3 22	4,363 2 22	4,394 2 16	144,678 1 18	25,054 1 24	169,732 3 14
18.									
.	28,260 1 25	423 2 26	28,684 0 23	32 3 7	3,668 1 12	3,701 0 19	135,842 0 19	22,763 0 6	158,605 0 25
.	31 0 10	..	31 0 10	..	..	..	294 1 22	..	294 1 22
.	23,291 2 7	423 2 26	28,715 1 5	32 3 7	3,668 1 12	3,701 0 19	136,136 2 13	22,763 0 6	158,899 2 19

PRICES of BUTCHER-MEAT.

	SMITHFIELD, *Per Stone of* 14 lb.		MORPETH, *Per Stone of* 14 lb.		EDINBURGH, *Per Stone of* 14 lb.		GLASGOW, *Per Stone of* 14 lb.	
Date.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1837. Nov.	6/3 @ 7/9	6/6 @ 7/9	6/ @ 7/6	6/6 @ 7/9	6/ @ 7/	6/3 @ 7/3	6/6 @ 7/3	6/3 @ 7/3
Dec.	6/6 8/	6/9 8/3	6/3 7/6	69 7/9	6/3 7/6	6/3 7/3	6/6 7/6	6/6 7/6
1838. Jan.	6/9 8/3	6/9 8/6	6/6 7/9	6/9 8/	6/6 7/9	6/6 7/9	6/6 7/9	6/6 7/9

PRICES of English and Scotch WOOL.

ENGLISH, per 14 lb.—*Merino*, 24/6 @ 26/6; in Grease, 14/6 @ 19/6.—*South Down*, 16/ @ 22/; *Leicester*, g, 18/ @ 21/; Ewe and Hogg, 15/6 @ 18/.—*Locks*, 10/ @ 11/6; *Moor*, 7/6 @ 10/6.

SCOTCH, per 14 lb.—*Leicester*, Hogg, 16/ @ 18/6; Ewe and Wether, 14/ @ 16/.—Ewe, 10/6 @ 13/6; *Cheviot*, ite, 10/6 @ 15/6; Laid, Washed, 9/6 @ 11/; Unwashed, 7/6 @ 8/6; *Moor*, White, 7/6 @ 8/6; Laid, Wash- 6/6 @ 7/6 Unwashed, 5/6 @ 6/.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of Jan. 1837, and 5th of Jan. 1838,—shewing the Increase and Decrease on each head thereof.

	Quarters ended Jan. 5.		Increase.	Decrease.	Years ended Jan. 5.		Increase.	Decrease.
	1837.	1838.			1837.	1838.		
	£	£	£	£	£	£	£	£
Customs, ..	4,069,938	4,523,278	453,340	..	19,716,440	18,826,284	..	890,156
Excise, ...	3,803,764	3,590,864	..	212,900	12,744,174	11,794,338	..	949,836
Stamps, ...	1,573,529	1,544,400	..	22,129	6,750,421	6,432,153	..	318,268
Post-Office,	349,000	376,000	27,000	..	1,490,000	1,517,743	27,743	..
Taxes, ...	1,594,650	1,579,028	..	15,622	3,689,761	3,677,748	..	12,013
Miscellaneous,	9,273	174	..	9,639	40,830	34,936	..	894
	11,400,764	11,613,744	480,340	260,360	44,431,626	42,283,202	27,743	2,171,167
	Deduct Increase,		260,360		Deduct Increase,			27,743
	Increase on the quarter,		219,980		Decrease on the year,			2,143,424

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PRINTED BY NEILL & CO. OLD FISHMARKET, EDINBURGH.

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